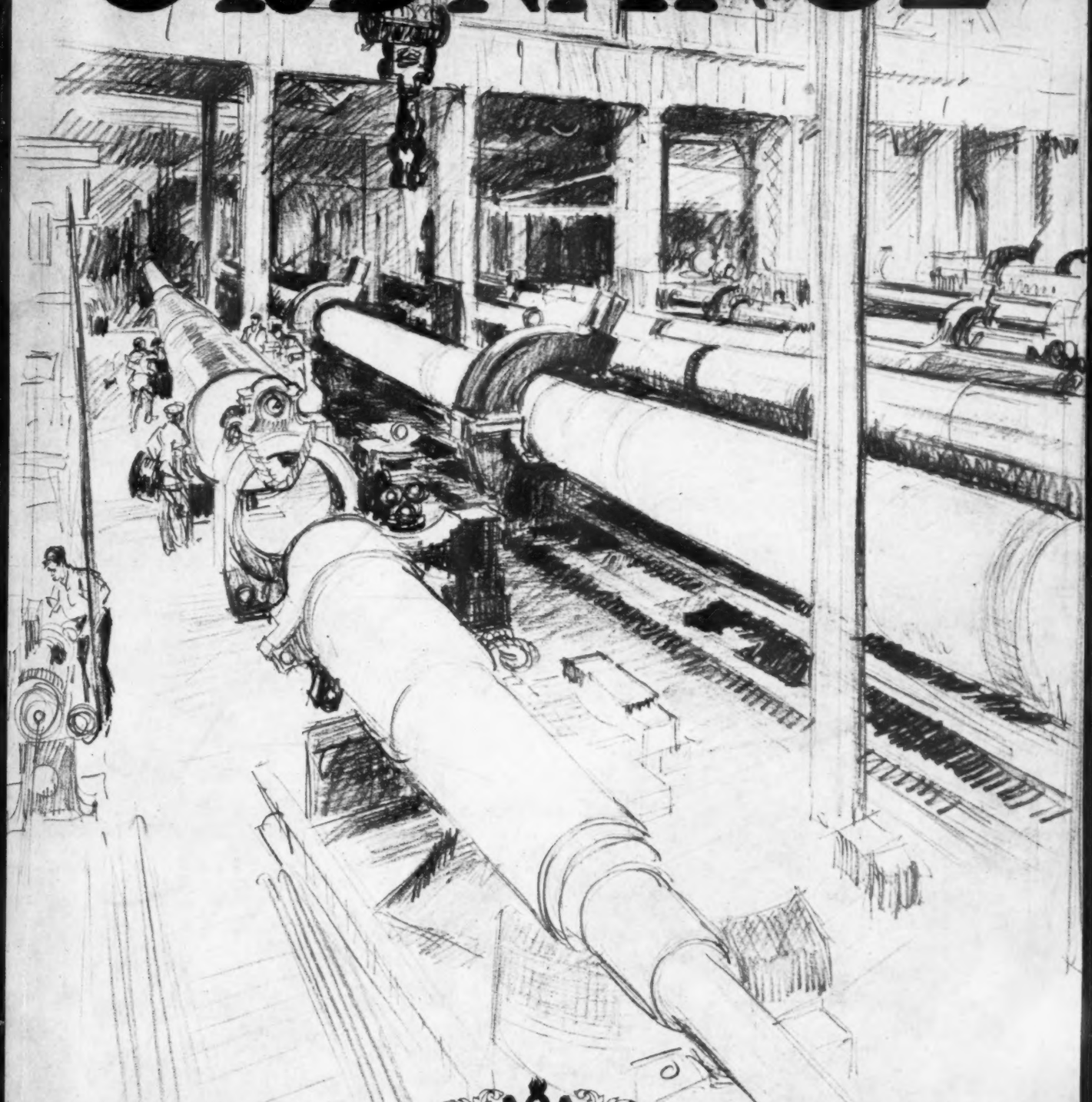
ARMY ORDNANCE



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ARMY ORDNANCE

The Journal of the Army Ordnance Association

Pledged to Public Service in Effecting Industrial Preparedness for War as Our Strongest Guarantee of Peace

Published by the Army Ordnance Association, Suite 805, The Mills Building, Washington, D. C. Editor: L. A. Codd.
Authors alone are responsible for statements made and opinions expressed in their respective articles. Specially written articles on appropriate subjects are solicited.

Issued Bimonthly. Single Copy 75c.
Subscription rate: Continental U. S. $4.50 per annum, foreign $5.00, in advance. Entered as second-class matter August 14, 1920, at the Post Office at Washington, D. C., under the Act of March 3, 1879. Additional second class entry at the Post Office at Richmond, Va.

Volume XII | MARCH-APRIL, 1932 | No. 71

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"Certain patriotic citizens have realized the importance of adequate industrial preparation and have voluntarily organized to assist in this work. The Army Ordnance Association comprises such a group, upon which the War Department leans heavily in carrying on the many activities incident to this type of preparation."

Frederick H. Payne, The Assistant Secretary of War.

The Army Ordnance Association

THE Army Ordnance Association is a national organization of American citizens pledged to industrial preparedness for war as our nation's strongest guarantee of peace.

The Association endeavors to keep alive an interest in and knowledge of the design, production and maintenance of munitions. Other than a few manufacturing arsenals—six in all—there is no peace-time industry for the production of ordnance. Should war unhappily come again, industrial America will be called upon to produce munitions in great quantity and of intricate and unusual design. In an emergency time will not permit careful study or long preparation for the production of munitions. The problem is one of vital concern.

THE Army Ordnance Association believes that the solution of this problem, based on experience, lies in an active organization at all times coöperating with the Government. The principal objective of the Association is an active membership of American citizens, on whom the duty of design and production of munitions will fall in war, who will have an accurate and authentic knowledge of the complex requirements of ordnance. "Peace insurance" in this form is the foremost aim of the Army Ordnance Association.

The Association is purely patriotic; it has no commercial interests, no political alliances, and no religious affiliations. It is not operated for profit: its income is expended in furthering its aims. Its officers and directors serve without remuneration.

ARMY ORDNANCE, the journal of the Association, is published solely for the purpose of disseminating information on the progress of our munitions developments so that American industry may at all times know its responsibilities to the common defense.

The objectives of the Association as set forth in its Constitution are:

To assist in effecting industrial preparedness for war as being one of the nation's strongest guarantees of peace;

To keep available the highly specialized knowledge necessary for arming the manhood of the nation by stimulating interest in the design and production of ordnance material;

To promote mutual understanding and to effect cooperation with American scientists, inventors, engineers and manufacturers in civil life and the regular and reserve officers of the Ordnance Department.

To provide, when required, the services of competent committees to investigate and report upon special ordnance subjects;

To assist in developing and maintaining an efficient personnel, both commissioned and enlisted, for the units required for Ordnance Field Service in the event of an emergency;

To commemorate the services rendered by the industry of the nation and by the officers and civilian employees of the Ordnance Department in the wars in which the United States has been engaged.

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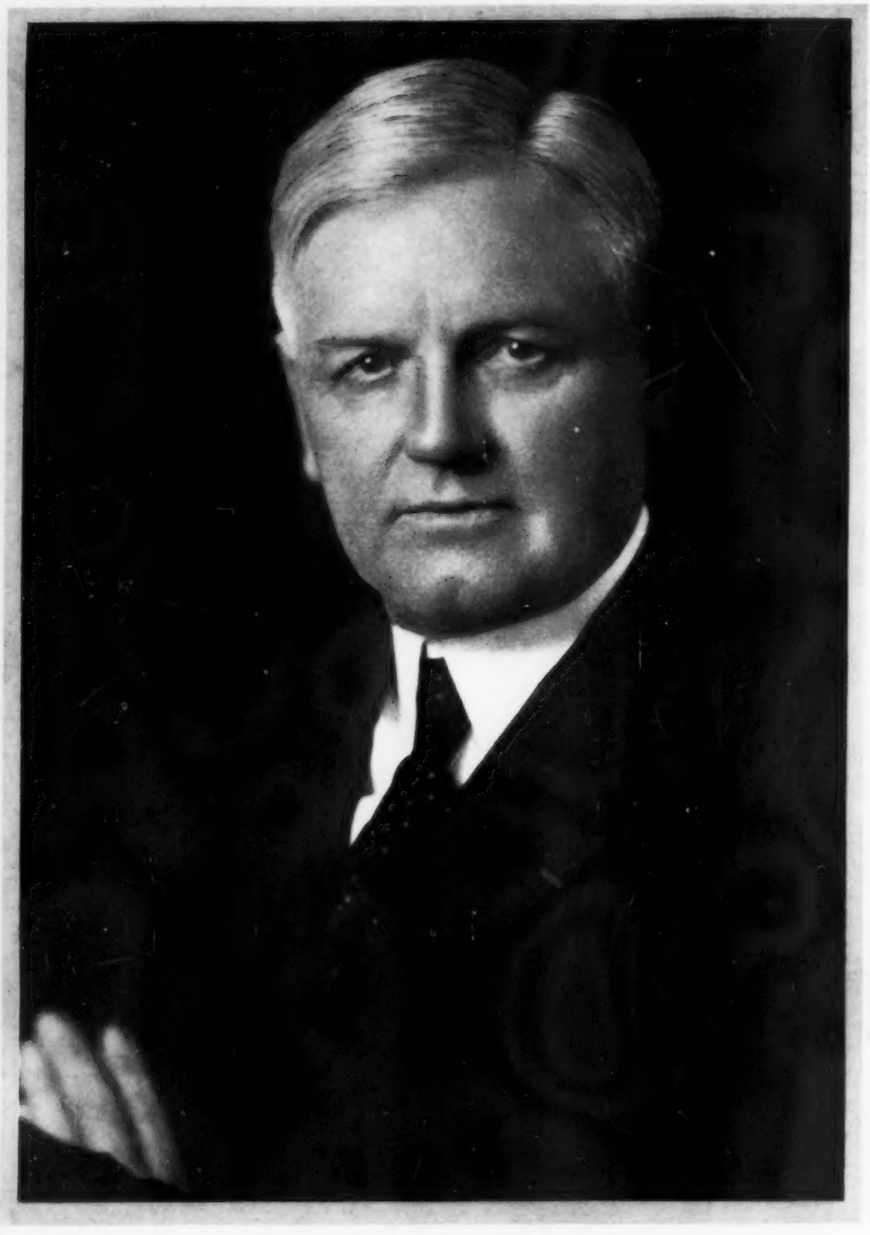


Brig. Gen. Samuel McRoberts, Ord. Reserve

Recently Appointed Chief of the New York Ordnance District.

ARMY ORDNANCE

VOL. XII MARCH-APRIL, 1932 No. 71

Industrial Minutemen of Today

The Mission of Those Who Foster Munitions Preparedness

By Hon. Frederick H. Payne*

THE responsibility for this country's defense rests now, as it has always rested, directly upon the shoulders of its citizens. More than a century and a half ago, a group of New England farmers earned the name of *minutemen* by abandoning the plow in the furrow to snatch rifle and powderhorn and repel an invading army. Since that time the nation's security, in emergency, has always depended ultimately upon a force of citizen soldiers hastily mobilized around a small professional army.

Our experience in the World War brought to our attention more forcibly than ever before that effective armies can no longer be quickly extemporized. Time is required in which to transform recruits into a modern army, and *even a greater length of time* is required in which to convert a wealth of raw materials into military supplies and equipment. Although we were actively engaged in the World War for over nineteen months, the American Army, at the date of the Armistice, was still dependent upon our Allies for some of the most critical items of munitions. Our people poured into the lap of the government—men, materials and money without stint. Wastes, delays and extravagances were the inevitable results of attempting their conversion into fighting forces without a definite, previously prepared plan. Some authorities believe that our industrial unpreparedness at that time finally resulted in unnecessary expenditures of more than eight billion dollars. We can not even attempt to evaluate the additional risks incurred or the additional lives sacrificed.

During the nineteen months following our declaration of war against Germany the expenditures of the American government exceeded twenty-two billion dollars. During the final stages of the conflict our expenses averaged about two million dollars an hour. These figures are so great as to be almost meaningless, but by way of comparison the amount we paid out in that period exceeded the total disbursements of the Federal government during the whole century immediately preceding the outbreak of the European war.

In contemplating such a financial outlay the thought naturally occurs, "Were all these expenditures necessary?" The answer is that "Under the circumstances they were." Nevertheless, costs were immeasurably greater than they should have been, and the question arises, "What were the circumstances that compelled us to make these excessive expenditures?" Briefly they were as follows:

In 1917 we had no previously prepared industrial program, and there was but one means available for stimulating essential production—namely, the offer of high prices for desired commodities.

We had failed to devise a system for coördinating the efforts of governmental purchasing agencies, with the result that competitive bidding among them for the products of individual plants was common practice. This naturally forced the prevailing high prices to still higher levels. In March, 1917, the average price of metals in the United States was, due to the effects of the European war, 247 per cent of the average for 1913. In spite of this extraordinary situation, metal prices soared still further when we began placing orders for our own munitions, and reached their peak in July, 1917.

Particular plants, well known to purchasing officers, were overloaded with contracts that manifestly could not be executed, while many others were left with nothing to do. There being no accurate estimate of the amounts of supplies the armed forces needed, contracts for some items were placed far in excess of requirements, resulting in a waste of materials and of manufacturing capacity.

WE have sought to profit by the lesson learned at such great cost in that war. The National Defense Act was amended in 1920. In the belief that proper organization and careful planning could materially reduce the difficulties involved in the procurement of munitions, Congress provided a centralized agency to carry out this work. The Assistant Secretary of War was made responsible, under the Secretary of War, for the preparation of complete and adequate plans for the procurement of army munitions in emergency, and for the development and correlation of plans for national industrial mobilization in time of war. For the first time in the history of the War Department all matters regarding procurement and procurement planning were made the primary responsibility of a single individual.

As a result of this legislation there were established in 1921 procurement planning sections in the supply branches, and a planning branch in the Office of the Assistant Secretary of War. The fourteen War Department Procurement Districts as they exist today were established in 1924. In order to provide organized training in procurement and procurement planning methods, the Army Industrial College was established in 1924. In this school are being trained officers to carry on the planning work, and to function in the great procurement organization that the Army would necessarily establish in time of war. This in brief is the genesis of our present war procurement organization. It is youthful—and it is wholly without precedent in our Army or in that of any other country. Considered

*The Assistant Secretary of War. This is an address delivered at a meeting of the New York Post, Army Ordnance Association, held at the Army and Navy Club, New York City, February 5, 1932.

in relation to these facts, our achievements to date in planning for war procurement and for industrial mobilization are really revolutionary.

IN modern conflict the quantity of munitions required staggers the imagination. Procurement planning must ascertain in detail the types and quantities required and exactly where and how each item is to be procured. Even after this has been done, there remains a great group of related questions that must be cared for. Prices of essential commodities and raw materials must be governed to minimize the inflation that, uncontrolled, would add greatly to the disorganization of our industrial structure and the cost of war. Capital must be provided for the ready expansion of essential industries and to provide new facilities where no suitable facilities exist. We thus have two distinct, but closely related, problems to solve. We must first plan for the procurement of the required munitions. These plans must be specific and detailed. We must then provide preparatory plans of nation-wide scope by which our industrial resources may be mobilized to the tasks of war. This includes plans under which the President could regulate such matters as priorities, prices, foreign trade, and similar matters. These broader plans we refer to as plans for industrial mobilization.

I wish to point out briefly some of the high lights in our record of accomplishment. We have, at the present time, specific information regarding the capacity of some 12,000 industrial plants to produce munitions. This record is kept up-to-date and shows the particular item and the volume of production that may be expected from each plant. The plant executives have coöperated in supplying this information and have checked the estimates in each case. We have also made great progress in the preparation of standard specifications for each item to be procured. In all, some 17,000 specifications are required, of which about 9,000 are now available. In the field of industrial mobilization preparatory plans to enable the President to control and coordinate the national industrial effort have been drawn up and submitted to other government departments and to representatives of Congress. These accomplishments may be of the greatest importance to our national security in some future emergency.

NOTABLE also is the growing spirit of accord and cooperation between Army and Navy in matters of procurement planning. Any munitions procurement program developed by the Army is directly affected by Navy procurement. Frequently we must turn to the same industrial sources. The growing appreciation of this mutual interdependence is evident in both services. The Navy sends each year an increasing number of officers from both Navy and Marine Corps to attend the Army Industrial College. Navy planning representatives lecture before that school each year. There Army and Navy officers become acquainted with the problems and methods of industry. The Army and Navy Munitions Board operates to iron out munitions problems that affect both services. We are now working together in full appreciation of the fact that a satisfactory solution can only be obtained through joint action.

Through coöperation with the Navy we are enabled to approach industry with a coördinated munitions procurement program in which conflicting demands of the two services have been adjusted. This is essential to the maintenance of that close relationship with industry so necessary to the success of our procurement plans. We learned to our sorrow in the World War that we could not distribute the huge volume of war orders directly from Washington. Our contacts with industry must be intimate and local. The present procurement district system supplies such contacts. It provides another valuable feature. Through the district advisory boards the War Department is furnished the advice and guidance of the leading industrialists of the nation on problems arising in their respective districts. Their services upon the advisory boards will be of the greatest benefit in eliminating production difficulties and expediting munitions production.

To shorten the time required in emergency to organize and train manpower we maintain in peace a nucleus of highly trained personnel, and annually give a limited military training to a small proportion of America's youth.

NO effort has ever been made to base a system of National Defense on a large professional army, but rather on a small standing army as a nucleus of a trained citizenry. The present War Department is not simply the headquarters for the Regular Army but rather it is the G. H. Q. for a military system made up of a small Regular Army, the National Guard, the Organized Reserves, and the young men we have in training at our schools, colleges and training camps. The Regular Army component is small but it is in being all the time, and it must carry the burden of the whole system. It must do this in addition to having about thirty per cent of its strength in our overseas garrisons.

As we consider the possible difficulties that may arise in a world torn by industrial and social disorder, it is most reassuring to realize that we have an organization which reaches every town and community and which would be a great stabilizing influence in the event of any trouble—remembering also that the framework of this organization is so adjusted as to absorb the manpower of this nation quickly and efficiently if it ever became necessary.

But an army without munitions would be at the mercy of its foe. Consequently, the steps I have so briefly outlined with respect to procurement planning are vital responsibilities of government. They may be the determining factor if we are drawn into another major conflict. The ability of a part of American industry to turn promptly, in emergency, from normal pursuits to the manufacture of munitions of war is essential to our national security.

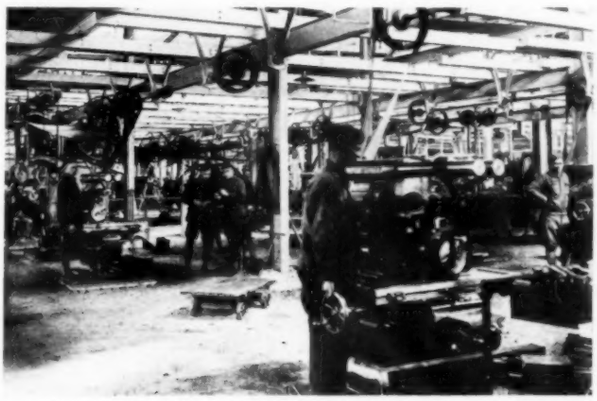
Certain patriotic citizens have realized the importance of adequate industrial preparation and have voluntarily organized to assist in this work. The Army Ordnance Association comprises such a group, upon which the War Department leans heavily in carrying on the many activities incident to this type of preparation. It promotes the peace and security of the nation by developing that ready strength which discourages aggression. It helps to insure that each American soldier of any possible future conflict will march to the front with an up-to-date counterpart of the flint-lock musket and the well filled powderhorn. Your study and efforts facilitate a prompt response from the Nation's industry in a possible hour of need. Members of this association are industrial minutemen of today.

Unknown Soldiers

Officers and Men of the Ordnance Depots in France

By George S. Brady*

SOME day some patriotic organization may put up a statue at the little insignificant French village of Mehun-sur-Yevre to commemorate the ten thousand grimy Americans who toiled there. Beside the inspiring statue of Jeanne D'Arc, which represents there in the village square the chivalry of the fighting soldier, some appreciative engineering society may erect a statue of the first machine-age soldier with his heavy boots, overalls and sweater—his armament a wrench and a welding torch. This American of Mehun-sur-Yevre was a soldier on official records, but no bugle called him except to labor. He never paraded except to be inspected.



A Corner of the Machine Shop at the Great U. S. Ordnance Base, Mehun-sur-Yevre, France.

Back in the patriotic days of 1918 every fireside orator could talk of a mechanical war where machine guns rattled out streams of fire and big guns hurled tons of steel for thirty miles. But how many talked of the sweating mechanics who worked like mad under the hell of battle at the very practical business of keeping recoil mchanisms working, changing the rapidly eroding gun tubes, sorting the devilishly dangerous high explosives and detonators, and following on the heels of the infantry and artillery picking up and salvaging the filth-covered machinery of battle?

Glory in war is pictured as a soldier majestically rushing forward with fixed bayonet. Heroes of the news stories were always made "over the top" in 1918, but this really first machine-age war called for still another type of unsung hero—a dirty, greasy, blue-denimed mechanic in an open field bending over a dismantled tractor in the intermittent light of searching flares mending a broken rod that would enable the artillery to move more guns into position before dawn! Mehun-sur-Yevre was the heart of that first mechanical war. Out of it came the life blood of mechanized battle, and out of it functioned the toilers who made possible the glory, but who received no part of it.

Just before the Armistice, when millions of anxious people at home were watching hourly the news of the American advance that was to break the German line, sixty-two batteries were massed in front of Mars-la-Tours. It was a typical position, and a little band of twenty-eight of those ordnance mechanics and two officers, with twenty-four tractors and three machine shops on trucks, had the big job of maintaining the guns, dragging back those that became badly smashed, bringing up ammunition, and hauling up barrels of oil and grease for the recoil mechanisms.

An average of three guns were out of action at all times in this one group of batteries from September 26 to November 11 as a result of the rapid fire. Parts for them were made up in the portable machines from captured German steel. Throttle valves on the guns were packed sometimes with strips cut from clothing or from belts. The constant use of the tractors day and night by unskilled drivers pulling guns into position, and the continual striking of shell fragments, made difficult repair jobs—broken cylinders, smashed frames, and burned-out bearings.

All this was contemptuously sordid business, with little chance for the real thrills of a soldier. Perhaps, back in the United States, where manufacturers had organized their production activities to manufacture the mechanical sinews of war in such tonnages as had never been dreamed of before, some few of the public might have pondered on how these highly specialized mechanical products were to be used effectively by the mixture of clerks, lawyers and laymen who made up the armies in the field. But the major thought seemed to be to make more and more guns, shells and tanks, and send them to the front. It was a mechanical war, and mechanical things always work by themselves, like the engine in your automobile.

WHEN the war began for us in 1917 only ninety-seven officers and a few enlisted men constituted the Ordnance Department of the United States Army. Spread those out thin, very thin, over the Regular Army as it stood on April 4, 1917, not to speak of the National Guard of forty-eight states, and it made a sad picture of preparation, or unpreparedness, for a machine-age war. But then came a still sterner picture. The fighting army grew in multiples month by month into two million men in the zone of combat, while ships raced in convoys across the ocean, disgorging their cargoes of mechanical things and racing back for more. How colossally useless the terrible looking tank if its mechanism would not function as a unit! How impotent the majestic big gun if one little packing gland were worn thin! Did the thousands of eager soldiers who marched down to the boats ever give a thought to the futility of their courage if these machines of war failed them in a crisis?

In a mechanical war it is not merely the guns that can

*Managing Editor, *Product Engineering*. Former American Trade Commissioner to Argentina, Uruguay and Paraguay. Lieutenant Colonel, Ordnance Reserve, U. S. Army.

be sent to the front nor the rifles that are toted up on the shoulders of the infantrymen that count in the long run. It is the gun that works after it has been dragged through the mud that is decisive. It is the rejuvenated rifle that can be thrust into the hands of the doughboy when he finds his toted gun is jammed with rust and dirt. It is not just quantity of high explosive that makes a successful barrage, but the carefully lotted and graded shells so arranged as to fire control that the projectiles will not fall on one's own men.

Overhauling and Star-gaging 75-mm. Guns at Mehun.

A moving tank is a majestic sight. It gives a thrill of courage to the accompanying infantry waves, and strikes demoralizing terror to the attacked. But in its fiery hot entrails, walled in with reverberating steel, the dirty, grimy men in denims must strain their ears above the blasting cracks of the engine to catch the changing pitch and tones of the crawler shoes as they tear over the geared wheels. These men are soldiers, but not in the old established meaning! To the mechanics who bore the responsibility of keeping those machines of battle in working order there were few thoughts of glory or of enemies. Only this—would the terribly gritty mud clog up the bearings? Did that new clanking sound mean that a pivot pin was worn almost through?

Big guns cannot be relined without machines, smashed frames cannot be repaired without skilled welders and mechanics, guns cannot be overhauled without mechanics and shops. And in the summer of 1917 those few officers of the Ordnance gave these matters grave thought. The first organized drive for skilled men went out in December, 1917, after months of day-and-night planning and ordering of equipment. Ordnance officers toured New England and the manufacturing sections of the Middle West. Advertisements with flaring headlines were inserted in the newspapers, all paid for from private donations because this form of publicity did not figure in any appropriations.—"Fight with the army behind the army. Work at your trade in France." Long lines of men—intelligent, eager—answered those advertisements in such industrial cities as Bridgeport, New Haven, and Cleveland. About ten per cent of the men interviewed were accepted.

THESE men were to wear the uniform and endure the privations, but glory of the soldier was not to be theirs. Nine thousand picked men were enlisted in the campaign, as the major part of a total of twelve thousand who constituted the thin band of technical skill that kept moving the arms and ammunition for the army in France.

The Ordnance was the "commercial class" of that army. It was the shopkeeper that supplied the guns, ammunition, tanks, tractors, gas shells, and other paraphernalia of battle. Its men were the mechanics who made possible a war of machinery, and in the final action they stuck day and night at the emplacements to repair and keep the equipment in action and feed up the ammunition. Beyond that they were out of the glories of war. Thinking back to those mechanics who gave up lucrative skilled jobs to enlist, it still remains enigmatical what constituted their recompense. While the workmen at home got ten to fifteen dollars a day and wore silk shirts, these men toiled obscurely in denims for a dollar a day and had to undergo a rigid army discipline. A stanza of a poem written by one of these soldier mechanics during the hectic days of cleaning up after the Armistice when thoughts were on the return home, went along something as follows:

"There won't be fly reporters
To ask *us* what we've done;
The most we'll get in press reports—
One line—like this, will run:
'A ship of Ordnance troops
Arrived today, as well—'
And the hero-loving reader
Will murmur 'What the hell!'"

Mehun-sur-Yevre was the radial point of Ordnance field activities in the A. E. F. Located there were the base repair shops and the main ordnance storehouses. There, also, was the great intermediate ammunition depot. From four to six thousand men worked at the base shops at Beauvoir and several hundred more worked in the shell yards at Foecy. Then came advance shops at Is-sur-Tille, with more than twenty smaller repair shops at artillery parks and aviation centers. A mobile ordnance repair shop was attached to each artillery division, and the larger "HMORS," or heavy mobile ordnance repair shops, with the army corps, having complete machine shops mounted on trucks and trailers, each with a captain and full company of picked mechanics.

All ordnance companies landing in France went first to Mehun-sur-Yevre where they were set to work putting up steel shop buildings and working on the machines, or sorting ammunition at Foecy. As the army units required skilled mechanics telegrams were sent to Mehun. Personnel cards were so carefully made out and cross-indexed that "deliveries" of these men could be made within a few hours at any time of the day or night. A telegram would come in: "One blacksmith, two welders, and an experienced fitter wanted immediately, report Ordnance officer at X division Epernay." In an hour four men with blanket rolls packed were being whisked to the junction to catch the next train for the direction of the Front. And there were plenty of human touches to this constant chess-playing of men, for the type of men capable of doing this work never became robots.

MEHUN had the title of the madhouse of the A. E. F. The whole army called it that. When uniformed men gathered in the leave areas there were the friendly exchanges of names and attachments. But always the announcement of officers domiciled at Mehun-sur-Yevre were greeted with

sundry "Ohs" and "Ahs," while the enlisted men always got the counterquestion, "For Gosh sakes, are you in that dinged place?"

For that matter the entire Ordnance in the A. E. F. was the butt of the line soldiers' jokes. When the line officers became peeved at any show of guarding supplies too carefully, they called the Ordnance the "Jewish Infantry." The S. O. S. insignia on the shoulders of the Service of Supply men was interpreted sarcastically "Still out of service." "The alphabet gang" was another favorite, inspired by the letter symbols, such as HMORS, used on packing cases and in correspondence. Other nicknames and sarcasms were legion.

Mehun was the madhouse, because the general run of line troops did not understand ordnance men. When anyone is different from the crowd he is either a genius or he is mad, and that is where Mehun presumably stood. Soldiers came to France to fight enemies, and how could a line soldier know that men who built steel shops and turned bars of metal in a lathe were soldiers?

Ordnance men, too, carried around with them what the line soldiers called a "Go-to-hell atmosphere," and didn't seem to worry about the jokes being on them. This was simple enough to understand when once you lived and knew the men at Mehun. There was mud at Mehun, oceans of it, and at times a terrible feeling of futility in working, working, working, without news, without a chance to hear the sound of a gun, or to feel the thrill of advance. But why shouldn't the Ordnance man who belonged to a company where more than thirty per cent were graduates of the major universities and the others were high-grade mechanics, draftsmen, and trained clerks, stick up his head and treat with contempt the jibes of the ordinary soldier, especially when he knew that soldier was dependent on him for the machinery of battle?

There was not a branch or unit of the whole American Army that did not at some time or another call on Mehun for help when skill and expert knowledge were required. Didn't the artillery yell to Mehun when guns wouldn't fire? Didn't General Headquarters telegraph when ammunition concentration dumps were to be placed? Didn't the quartermasters call to Mehun when printers and laundrymen were failing them? And when the war was over, didn't Mehun send intelligent interpreters in more than twenty languages to the Peace Conference?

Mehun was also a mudhole! The common gossip early in 1918 was that the French had looked over their maps and picked out the most undesirable and unprofitable part of the Republic for the rich and foolish Americans to build shops and develop as an industrial center. Mehun mud was a foot in depth, horribly soft, and with enough fine lime in the ground to make it slimy and sticky. Across the low field where the artillery shops were built there was an old Roman stone road two feet above the ground level, but the shop floor could not be raised to the level of the roadway without the cartage of enormous quantities of earth. Drainage ditches were made, but there were not men nor trucks to clear away the mud from the sides of the ditches, and the tractors and gun wheels splotched it down the shop areaways to make further cause for curses from the men operating the machines and slinging the loads to the cranes.

Blue jumpered mechanics in rubber boots worked at the cold machines in the rainy months of September and October, and warmed their hands at coke-pan open fires while the cuts were made in the lathes. As one ordnance poet in the artillery shop at the time put it:

"The fight at the front is a grand old fight,
And the fight at home is clean;
But fighting between in the Mehun mud,
Is the damndest fight I've seen."

A Section of the Salvage Yard at Mehun.

In all the mud a forge shop was set up, and hundreds of wrenches and tools were made for the artillery. A smelting furnace was built, and was ready by the time of the Armistice to melt down the millions of shell and cartridge cases into ingot metal that was badly needed by the Allies. By early October, 1918, the French supply command had recognized that the crazy American idea of transplanting an industrial city to the heart of their farming districts was yielding fruit. They called for help for their own rapidly failing manufacturing program, and long before the Armistice Mehun Ordnance officers visited the French arsenals and picked out the hardest jobs to do at the American shops. When November 11 came, parts from the French 75-mm. guns were being machined on the bright new planers and lathes in the Mehun mud.

BUT there might be still another statue on the monument at Mehun-sur-Yevre to the officers who directed those men—all highly trained executive engineers who might have made fortunes in war profits at home, and practically all of them above the draft age. They likewise had little thought of personal profits or of glory. There were no "soft hours," and they wore the same rubber boots, usually hiding even their rank in muddy trench coats.

To run shops of such magnitude in an orderly fashion there had to be systems laid out and organizations built up. Every detail was planned on the spot, and the Mehun repair shops were operated on control systems as effective as in the best at home. A local telephone system handled 1,500 local and 50 long distance calls a day, a regular hourly mail system was in effect to every working group, intershop trucking was done by electric platform trucks on regular schedules, a print shop was installed which printed all order and schedule forms, reports, and a weekly newspaper. A theater was built, plays and other entertainment for the men were staged, and trade schools were organized. An engineering department made drawings and plans for the articles to be built.

The thousands of workmen employed under such circumstances and working such long and irregular hours with such slight compensation could not have been held together for efficient work without an exceptional display of sacrifice, efficiency, and sympathy on the part of their officers. The man under such conditions who approached his captain holding in his hand a letter from his mother or sweetheart telling that John Jones, the town bum, was getting fifteen dollars a day at home for eight hours' work in a munitions factory, presented a problem in morale that would defeat any but the most patient officer. But Mehun had one of the best, if not the best, record in the A. E. F. for absence of crime. In a town of 6,000 grown men there are always some who defy the law, but at Mehun the jail was a tiny shack that seldom had more than three or four temporary inmates.

Dismantling Rifles for Cleaning and Repair at Mehun.

AND what of the field work of the mechanical soldier? The famous "Soldiers' Chorus" was never written to apply to the grease-stained soldiers of a modern mechanical war. The opening line, "Courage in heart and a sword in hand," might serve with the word wrench substituted for sword. Grim, determined, plugging, mechanical dullness! Much of it not different in technique from the work of the garage mechanic under the car at home, but dirtier, out in the open, always working feverishly against time, often with hands numbed with cold, sometimes in black darkness punctured only by the flash of guns or the white glare of flares!

Take a divisional mobile shop for example—one which followed the 4th Division through the July and August offensive in 1918! Fifty-three mechanics with three officers manned the artillery repair truck, two equipment repair trucks, and parts supply trucks. The former carried a lathe, drill, grinder, motors, pump, and compressed-air tank. The lighter trucks carried benches, bins and small tools. At Fere-en-Tardenois the shops were set up in an orchard just abandoned by the Germans. Guns were dragged in, cradles were changed, broken parts were repaired, while shells came over intermittently and the smell of dead men and horses exposed to the summer sun was always with the men as they worked. Details of mechanics rushed back and forth to the front positions to make minor repair to the guns in action, while other details hauled back the badly disabled guns to Chateau-Thierry and rushed up barrels of grease and oil to fill the emptying recoil mechanisms. Careful mechanics at first put new tubes in the guns when shells stuck in the bore, but as time pressed more daring and reckless ones blew the shells out with extra heavy charges. Tube changing was done at night along the Vesle; then this shop went behind the lines to a "rest camp" where the days were spent in inspecting guns, overhauling equipment, and the nights in trips to the St. Mihiel sector where work was done by the light of continuously flashing guns. The shop moved up through the Argonne, repeating the experiences of the Vesle, the mechanics sleeping and eating when they could, always working the full double round of the clock, doing feverishly but surely at all hours the mechanical work that at home the exempted men thought required cold calculation and only eight hours a day.

Guns, tractors, caissons, and vast piles of shells and bags of powder to be devoured by the guns constitute the first equipment of an artillery regiment. But that equipment makes only paper warfare. There are hammers, sledges, wrenches, spades, shovels, lanterns, ropes, chests, rams, axes, vises, blocks, tarpaulins, and spare accessories; small wrenches that lose themselves easily in the mud to 300-pound lifting bars for the G. P. F. guns! Actually there were five carloads of miscellaneous equipment pertaining to every artillery regiment, and in those long rainy days and nights of September and October every piece was mud covered, rusted, spattered with blood and filth. They had to be picked up, scraped, cleaned, oiled, moved, and the process repeated over and over in endless monotony by these ordnance men as the artillery moved forward.

The ordnance mechanics were the circus men of this machine-age war. Artillerymen were real soldiers, with no thought for salvaging and moving miscellaneous equipment. The American artillery that went up into front lines at Sieprey in April, 1918, and with the 26th Division at Apremont Woods, had less than thirty ordnance men. These mechanics were at the guns all the time with no relief night or day. Two battalions of American-built 8-inch howitzers at Champagne fired for two days and two nights without stopping, working relief crews of artillerymen, but there were no reliefs for the grimy mechanics. Sixteen guns went out of action the first day from the hot working of the recoil mechanisms, and always instant repair was called for. These same ordnance men dragged up the ammunition from the dumps and exposed themselves continuously on the roads and across the fields. At St. Mihiel 5,600 rounds of 8-inch shells were fired by three battalions in 8 hours. Ordnance men had massed the shells into dumps behind the lines, and these shells had to be sorted and brought forward as the lines advanced during the battle. Improper or careless sorting meant death to their own men in barrage firing.

What a glorious life is that of the military flyer in wartime! The public thrills at his deeds of daring. On leave in France he wore the natty, low-cut uniform of English design, and was the "ladies' man" of the A. E. F. To the ordnance mechanics he was a "bone head" who couldn't seem to understand the different types of aircraft armament, and was forever "jamming" the machine guns by lack of

attention and blaming it on the mechanical construction. Eighteen ordnance men were with each flying squadron in France. The machine guns were rigged up and timed by gears to shoot between the blades of the revolving propeller, and it was the ordnance job to keep them in repair and to instruct young flighty flyers in their operation and care. In June, 1918, a school was established at St. Jean de Monts where 40 officers and 700 enlisted men were instructed monthly.

WILL there be another great war, and what will a real advanced machine-age war be like? The Romans thought that they answered the first part of that question just eighteen hundred years ago. We, Americans, with less than five per cent of the population of the world, now think the same thing, and there is more reason to presume that we are wrong than there was when the Roman pacifists were considering settling down to enjoy their fabulous wealth.

The Muhun News, May 16, 1919.

Officers of the Ordnance Base and Repair Shops, Mehun.

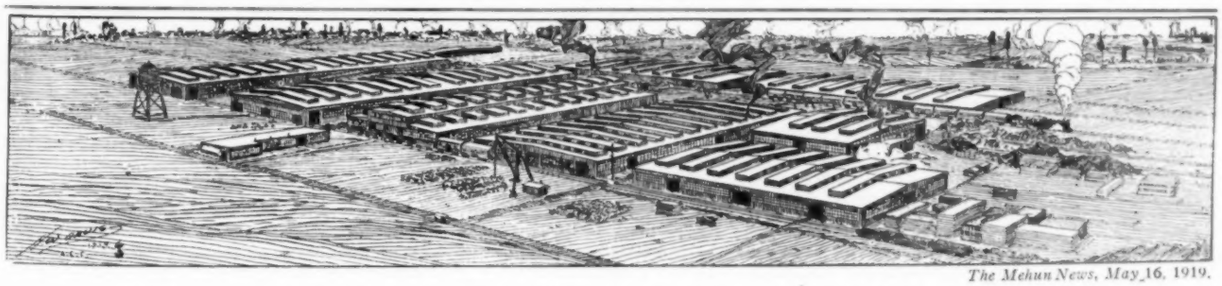
Left to right: Col. C. M. Wesson, Commanding Officer; Maj. J. E. Ericson, Salvage Dept.; Lieut. Col. A. B. Hubard, Inspection Dept.; Lieut. Col. W. W. Doe, Shops Dept.; Maj. G. S. Brady, Administration Dept.; Capt. O. V. Dodge, Stores Dept.; Capt. W. E. French, Adjutant.

If another great war comes there is not the shadow of a doubt but that every element of mechanical, electrical, and chemical genius enjoyed by the nations will be turned to the creation of instruments of war the like of which have never been known. There will be none to dwell "safe in the homeland harbor," for every community that manufactures munitions and the tools of war will be targets for the aircraft and the long-distance bombing rockets of the enemy. When we consider that the present-day peace-time Army aircraft mounts five machine guns and travels at nearly three times the speed possible in the last war, we can visualize the havoc that could be created in communities far behind the fighting lines. The long-range gun of 1917 was uneconomic, because it wore out rapidly, but with newer methods now available for replacing gun lining instead of changing tubes, we might easily picture guns as far off as Philadelphia or Baltimore hurling high-explosive shells into the streets of New York. The old lumbering tank of 1917 is now obsolete, and would be replaced in the next war by tanks of more resistant steel, and carrying high-explosive artillery, racing over the fields at forty-five miles or even more an hour.

In the next war the individual soldier will be as important as he ever was, but the new soldier of grease and machinery, whose total number in the war of 1917 was less than one per cent of the Army in France, will be one of the major factors. In this machine age, which we are now only barely entering, any war projected between two industrial nations will mean a reckless mechanical slaughter frightful to the nerves as well as to the bodies of the participants, and there will be developed an organization of mechanicians that will give armies a different aspect from anything they have had before.

EDITOR'S NOTE: In the September-October, 1928, issue of this Journal reference was made to an Ordnance band organized at the Raritan Arsenal in 1918 as "probably the first and only ordnance band ever organized." We are indebted to Lieut. Col. George S. Brady, Ord. Res., author of the above article, for additional data on this subject. When the first ordnance men were enlisted in the fall of 1917, practically the entire "jazz" band of the University of Michigan was enlisted, and at Camp Hancock the members of the band were concentrated in two companies, the 17th and 21st, which were going to France in the same battalion. The group arrived in England May, 1918, and in France the following month. After arrival at the ammunition depot at Foecy the personnel cards of these men were kept intact so that they could not be transferred. Months later, with this band as a nucleus, Major McAleer, under orders from Colonel Wesson, organized and procured the instruments for a full band.

Another ordnance band was organized at Camp Dodge, Iowa, January, 1918; arrived in France April 12, 1918; was stationed at Is-sur-Tille and returned to Mehun-sur-Yevre, January 15, 1919. In the following month the contingent from University of Michigan and that from Camp Dodge as well as a "pick-up" band that had performed at Mehun, were merged into one glorified aggregation of musicians under the direction of Sergeant Reginald W. Earnshaw. So unfolds the story of the engineer-musicians of Ordnance.

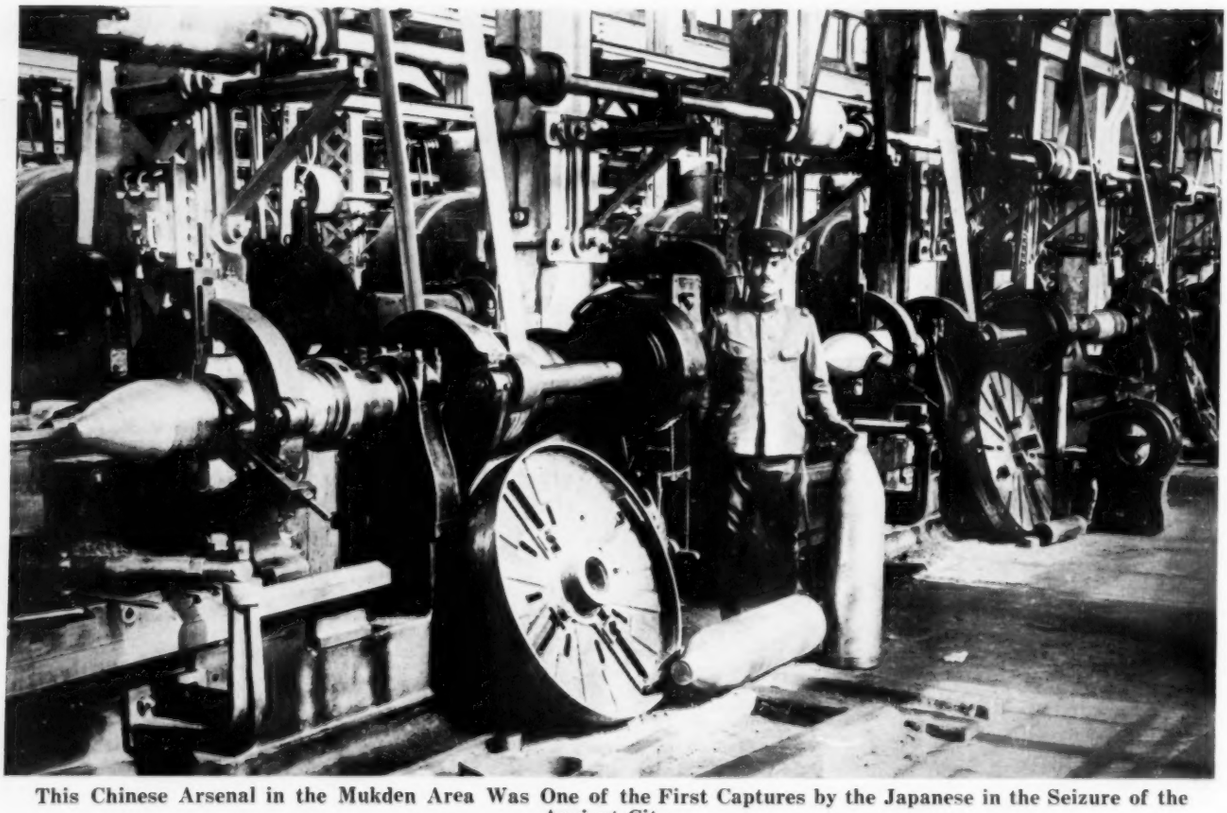


The Mehun News, May 16, 1919.

Warehouses and Shops of the American Ordnance Base Depot at Mehun-sur-Yevre, France, 1917-1919.

Ordnance in the Pacific and the Far East

U. S. Sailors and Marines Landing Tractors at Oahu, Hawaii, During Recent Army, Navy and Marine Corps Maneuvers in the Pacific.



This Chinese Arsenal in the Mukden Area Was One of the First Captures by the Japanese in the Seizure of the Ancient City.

Ordnance Service

Its Functions Between Interior and Combat Zones in the Field

By H. S. Aurand*

THE title is not "*Sales* and Service." There will be no need to sell ordnance supplies in war-time. The job will consist of making somewhere near enough of them, and then getting them to the point where they are needed. But there is a catch in that simple statement. They must arrive at their destination, and consequently must be produced, in proper proportion. To encourage this to happen, requirements are set up for each item. What slim encouragement requirements can be is known to every manufacturer who had an ordnance contract during the World War. In fact, as the ante was raised from an A. E. F. of 500,000 men to one of two million men in a few months, the computers of requirements became a bit foggy, and arrived at a few wild numbers. The wonder is that many more wild ones did not appear—for, strangely enough, the ordnance requirements for two million men cannot be calculated by multiplying the ordnance requirements for 500,000 men by four. What is still more tragic for the computer, these requirements for 500,000 men vary widely with the theater of operations in which they are to be employed. Distance, climate, nature of the terrain, equipment of the enemy, kind of warfare, and organization of the forces are all variables in the computers formula for prophecying requirements.

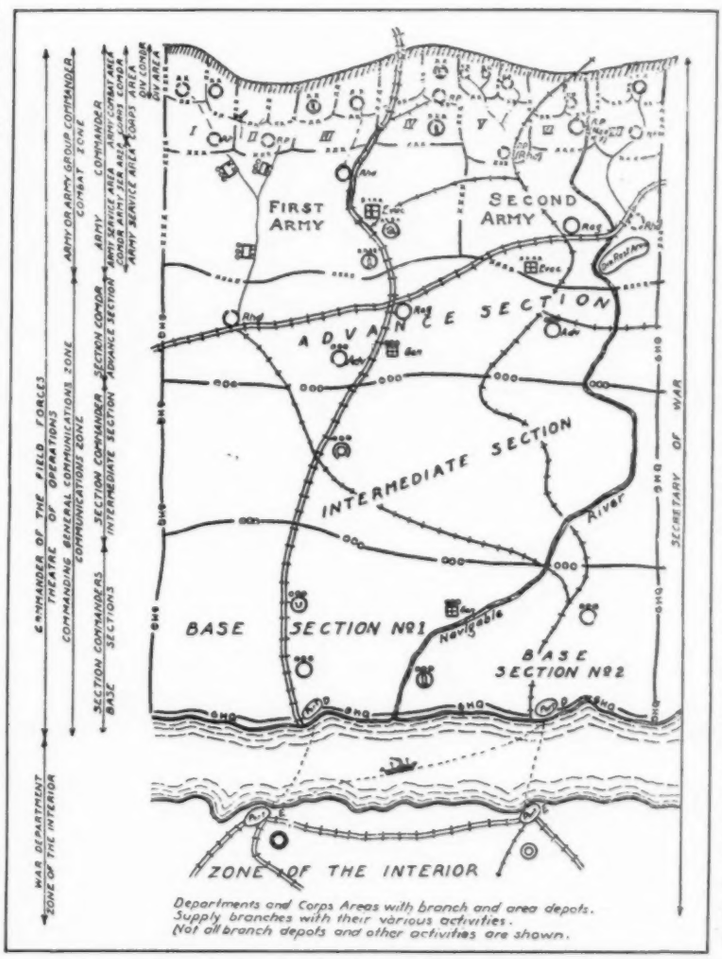

FIRST ARMY
SECOND ARMY
ADVANCE SECTION
INTERMEDIATE SECTION
BASE SECTION Nº1
BASE SECTION Nº2
ZONE OF THE INTERIOR
Departments and Corps Areas with branch and area depots.
Supply branches with their various activities.
(Not all branch depots and other activities are shown.)

Fig. 1. Organization for Supply in a Theater of Operations.

In the face of such difficulties in determining requirements, upon which orders are placed, what chance is there of securing production of ordnance items in even a distant approximation of the proportions in which they will be needed at the using end? Enjoy your own answer. Now add to this serene situation the daily demands by mail and wire for more of this, and less of that, which are reversed two days later, only to be reiterated within the week—demands from the sacred "front" which must be given attention—and you have the reason for such situations as thousands of tracks for tractors on hand but no water pumps. If ordnance supplies are to be delivered, when and where needed, in proper proportion, some agency must be set up to handle that part of the job, and at the same time take the shocks off the computer of requirements; and, as a result, off the producing industries. This agency has recently been named "Ordnance Service."

However, Ordnance Service was not conceived to assist the computer of requirements or the producer of ordnance supplies. It functions in the theater of operations. It's mission: to assist efficiently the operations of the field forces by the provision, distribution, maintenance and repair of the equipment and supplies issued by the Ordnance Department. It consists of all Ordnance personnel and facilities in the theater of operations.

Properly to appreciate just how Ordnance Service fits into the theater of operations, it is necessary to reproduce the rather shop-worn Fig. 1, and define a few terms.

The "theater of war" comprises those areas of land and sea which are, or may become, directly involved in the operations of war. That part of the theater of war within the control of a belligerent is usually divided into a "zone of the interior" and one or more "theaters of operations."

The theater of operations covers that part of the theater of war in which military operations are conducted. It includes all territory necessary for the location of establishments pertaining to forces in the theater of operations. It is usually divided into a "communications zone" and a "combat zone."

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The communications zone comprises that portion of the theater of operations containing the principal establishments of supply and evacuation, lines of communication, and other agencies required for the continuous service of the forces in the combat zone. In some situations the communications zone may become so extended in depth as to make further subdivision desirable. Fig. 1 shows the communications zone divided into advance, intermediate and base sections; and the base section further subdivided into Base Section No. 1 and Base Section No. 2.

The combat zone comprises the forward portion of the theater of operations. It is divided into "army areas." The forward part of each army area is divided into "corps areas." The remainder of each army area is termed the "army service area." The bulk of the army service troops and army establishments are usually located in this area.

Ordnance Service has been built to fit the organization for supply shown in Fig. 1. The backbone of Ordnance Service is composed of the ordnance officers on the staff of each commander from the division upward. By considering the duties of each of these ordnance officers, and the means available to them to perform their duties, a picture of Ordnance Service may be obtained. Consider first the ordnance officer at the top of this backbone—the directing head of Ordnance Service.

THE commanding general of a theater of operations is more commonly known as the "commander in chief." It follows that the ordnance officer on his staff is called the "Chief Ordnance Officer," or briefly the "COO." His duties, as officially prescribed, are as follows:

Preparation of a complete project for building up Ordnance Service, and for its expansion in conformity with the general organization project and established priorities; the efficient technical operation of Ordnance Service as a whole; the establishment and maintenance of uniform methods of administration, operation and procedure for all Ordnance Service units; *coöperation* with ordnance officers in subordinate commands in order to secure the maximum efficiency of their operations; development of new, improved, or special types of ordnance supplies and equipment to meet the particular requirements of the theater of operations.

The means available are his office, and the Ordnance Service personnel and facilities in the theater of operations. The latter are usually operated by the ordnance officer of the communications zone and the army ordnance officers.

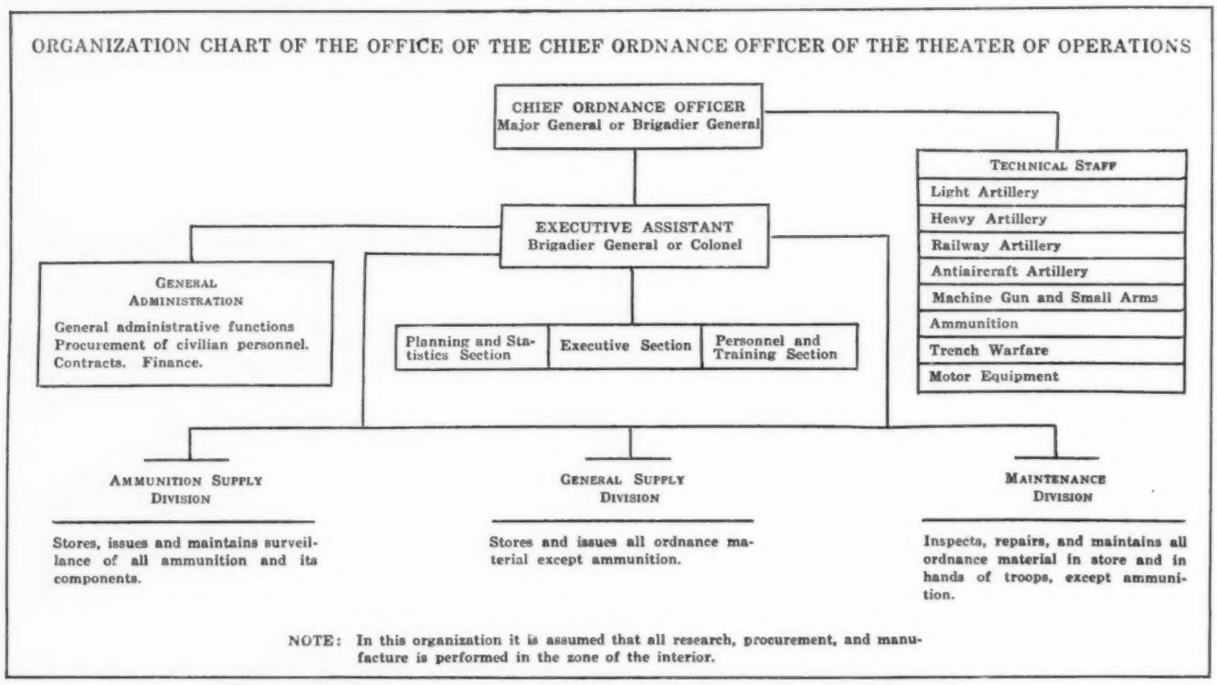
ORGANIZATION CHART OF THE OFFICE OF THE CHIEF ORDNANCE OFFICER OF THE THEATER OF OPERATIONS
CHIEF ORDNANCE OFFICER
Major General or Brigadier General
TECHNICAL STAFF
Light Artillery
Heavy Artillery
Railway Artillery
Antiaircraft Artillery
Machine Gun and Small Arms
Ammunition
Trench Warfare
Motor Equipment
EXECUTIVE ASSISTANT
Brigadier General or Colonel
GENERAL ADMINISTRATION
General administrative functions
Procurement of civilian personnel.
Contracts. Finance.
Planning and Statistics Section
Executive Section
Personnel and Training Section
AMMUNITION SUPPLY DIVISION
Stores, issues and maintains surveillance of all ammunition and its components.
GENERAL SUPPLY DIVISION
Stores and issues all ordnance material except ammunition.
MAINTENANCE DIVISION
Inspects, repairs, and maintains all ordnance material in store and in hands of troops, except ammunition.
NOTE: In this organization it is assumed that all research, procurement, and manufacture is performed in the zone of the interior.

Fig. 2. The Organization of the Chief Ordnance Officer, Theater of Operations.

A suitable organization for his office is shown on Fig. 2. The elaborateness of this organization and the methods of control employed depend primarily upon the strength and equipment of the forces in the theater; the character of the operation; the distance from the zone of the interior; the capacity, availability and character of the transportation facilities and their relation to the operations contemplated; and the availability of local resources.

The chief ordnance officer is the first agency of Ordnance Service which can be of assistance in bringing some semblance of stability to requirements. This assistance can be rendered in several ways. Perhaps the most effective means is proper planning, *i. e.*, anticipation of needs. This eliminates to a large extent the daily, often changed demands which so effectively throw monkey wrenches into the production machinery.

Note the technical staff in the office of the chief ordnance officer. Note also among his duties: "development of new, improved, or special types of ordnance supplies and equipment to meet the particular requirements of the theater of operations." These two items seem made for each other. They are. But a technical staff which assumes that its primary duty is to set up requirements for a lot of "special types of ordnance supplies" will certainly not help production at home. Rather they should busy themselves with discovering how the "ordnance supplies" already on hand in

the theater of operations, or in production at home, can be successfully employed under the special conditions which will be found in any theater. (This might stand paraphrasing for the benefit of our peace-time technical staff.)

FOLLOWING down the backbone of Ordnance Service, the ordnance officer, communications zone, is discovered as the next vertebra. He handles the details of Ordnance Service for the COO, and provides the combat zone with ordnance supplies and facilities in accordance with the latter's instructions. The official statement of these duties is as follows:

He will keep accurate records of all depot space occupied by Ordnance Service in the communications zone and make application and recommendations from time to time for such additional space or depots as may be required.

He will maintain stocks at the prescribed level.

He will furnish adequate personnel for the efficient functioning of the branch depots and ordnance sections of general depots.

He will keep records in such form that prompt report can be made whenever directed as to kind, quantity, location and condition of supplies available for distribution.

He will take such measures for the equalization of stocks between depots as may be desired.

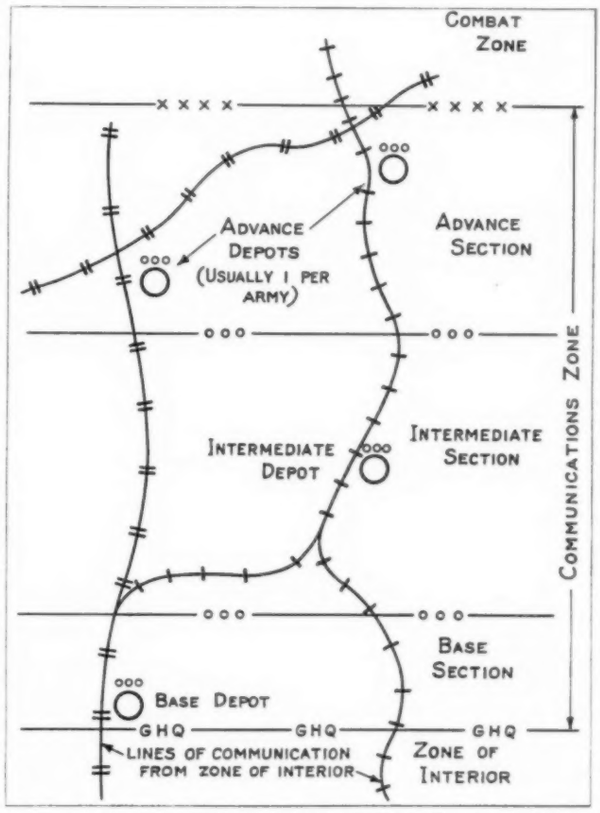

Fig. 3. Location of Communications Zone Depots to Give Flexibility to the Supply System.

He will report to the commander of the communications zone, with suitable recommendations, all items of supply with reference to which special action is required.

He is directly and immediately responsible to the commander of the communications zone for the supply operations of his branch depots and the maintenance operations of his shops.

The means available to the ordnance officer, communications zone, are his office, the ordnance companies made available to him by the COO, and the establishments which he creates. His office is organized much like that of the COO, with the omission of the technical staff. However, the personnel required to man his office is much greater than is needed in that of the COO, for as has been stated, the ordnance officer, communications zone, handles the details of Ordnance Service for the COO.

TWO of the principal functions of Ordnance Service in the communications zone are the receipt of supplies from the zone of the interior and the issue of supplies to the combat zone. A consideration of these functions will disclose the ordnance supply activities in the communications zone.

Ordnance supplies will arrive from various sources in the zone of the interior. Usually these supplies will be shipped in bulk. Upon their arrival in the communications zone, these bulk supplies must be unpacked, stored and prepared for issue to the combat zone. In order that there may be no delay when demand is made by the combat zone for supplies, it is necessary to prepare supplies for issue in advance of requisition. Once so prepared, these supplies must be segregated. This segregation of supplies is in approximately the proportions in which they will be issued. It is based on a "day of supply" which is defined as the estimated average expenditure per day of the various items of supply, except ammunition. The quantities of various ordnance items, which, taken collectively, will represent a day of supply, will be determined on recommendation of the chief ordnance officer for each particular theater of operations. The number of days of supply which are to be stored, ready for issue to the combat zone, will no doubt be prescribed in the theater of operations plan, upon recommendation of the chief ordnance officer. Depots which store supplies in proper proportion, packed for issue to the combat zone, are said to have "balanced stocks."

As will be demonstrated later, army depots are not suited to the operations of receiving supplies from the zone of the interior in bulk, and storing and repacking them for issue to subordinate units. Consequently, a communications zone depot should be established in a theater of operations as soon as practicable. Since there are two distinct types of storage required, namely, storage in bulk as material is received from the zone of the interior, and storage in balanced stocks, it is obviously better to have these two types of storage in different establishments. Then one depot receives supplies from the zone of the interior, and repacks them for issue to the combat zone. When repacked they are forwarded to a second depot whose sole functions are issue to the combat zone and the storing of the necessary reserves therefor.

One of the principles governing supply in the communications zone is that the supply system must be flexible. To obtain this flexibility, it may be necessary to establish still a third depot. Usually this contains balanced stocks. It is placed on another line of communication (Fig. 3) from the base depot and is so situated that it can either restock the advance depot or feed directly to the combat zone by an in-

dependent line of communication. This gives us the type communications zone set-up of base, intermediate and advance depots. The base depot carries stock in bulk. The intermediate and advance depots carry balanced stocks. However, direct shipments may be made to the intermediate depot in case facilities at the base become overtaxed. The sole purpose of the intermediate depot is to provide flexibility to the supply system.

Ordnance "general supplies" will usually be found in ordnance sections of general depots of the communications zone. Ammunition is usually stored in separate establishments, called ammunition depots. Consequently, these are branch depots. The division of stocks into base, intermediate and advance depots, with balanced stocks in the last two, is usually practiced for both. Ammunition in the base depot is stored by item; in the intermediate and advance depots, by complete rounds. Safety is obtained by separation—that is, by using small groupings of complete-round components with large distances between them.

THE process of establishing a supply system in the communications zone is usually as follows. The first large unit with supply functions to reach the theater of operations will be the army. It is provided organically with service troops. It will set up the necessary depots for its own supply. However, as soon as a communications zone headquarters can be organized and personnel assigned, these depots should be taken over by the communications zone. As the army advances, and other service troops are assigned to the communications zone, in order to segregate the functions of bulk receipt and balanced issue, the communications zone organizes a second section in which depots are established. And finally there are set up the additional depots necessary to insure flexibility of the supply system.

A depot commander or section chief of a communications zone depot has the following responsibilities:

He must bear in mind that supplies are not required for storage, but for use;

The function of his depot is to provide a base of supply for furtherance of operations; he is responsible for the technical functioning of his organization in all matters pertaining to supply;

He must watch his stocks closely and if any necessity arises for the special control of issue, he must bring the matter to the attention of the ordnance officer, communications zone, at once.

The Ordnance Provision System is used in reporting the status of supplies in communications zone depots to the ordnance officer of the communications zone.

When the communications zone is organized in sections, the section commanders do not participate in the operation of the depots in their section. An ordnance officer is provided on the staff of the section commander only when there are troops, rest areas, training areas, etc., which require Ordnance Service. The communications zone depot commanders report directly to the commander of the communications zone; and the various service representatives to the chiefs of their services at communications zone headquarters.

Maintenance in the communications zone is based upon communications zone shops. These may appear in each section into which the communications zone happens to be divided. They are usually set up either in connection with, or in close proximity to, the general supply depot in that section. The number and type of shops which will be set up in the communications zone varies greatly in different situations.

TRAFFIC into the theater of operations is controlled by the War Department. Priorities for men and supplies are announced after consultation with the commander-in-chief of the theater, or upon his recommendation. The machinery for the control of transportation exists now in the office of the Quartermaster General, in liaison with the American Railway Association and the United States Shipping Board. This arrangement will continue to operate in time of war.

However, no such agency exists in peace time for the control of movement of supplies and personnel from the communications zone to the combat zone. The same principles underlie the control of this movement. The army commanders having been given missions by the commander-in-chief of the theater, make known their needs to carry out these missions in both personnel and matériel, together with the priority in which they wish these needs met. The commander-in-chief then places at the disposal of the army commanders such matériel and personnel as he has available in the communications zone to meet these needs and establishes the priorities for forwarding them to the combat zone. This information is turned over to a regulating officer. He is stationed at a regulating station, which consists principally of railroad yards, and is located at a main junction point of lines running from the communications zone forward into the combat zone. No transportation can move to the regulating station from communications zone points without his consent, and all trains entering the combat zone are dispatched by him.

He has a staff on which all the chiefs of services are represented. Each representative is charged with the following duties:

He will make all calls on communications zone installations of his service for shipment of supplies into the combat zone in accordance with call made by the army, and established priorities.

He will supervise the operation of the personnel of his service stationed at railroads.

He is responsible for the maintenance at railheads of the supplies furnished by his service.

He is responsible for the correct forwarding of all supplies arriving at the regulating station, which are furnished by his service.

The key man in carrying Ordnance Service to the combat zone is, therefore, the ordnance officer at the regulating station. He is a direct representative of the chief ordnance officer. He is a middle-man between Ordnance Service supplies and facilities in the communications zone, and the Ordnance Service requirements of the combat zone. Largely upon his efficiency, good judgment and ability to coöperate will depend the successful performance of duties by army ordnance officers. He must be zealous in obtaining sufficient transport to meet all ordnance needs, and, at the same time, must have due regard for the needs of other services. In no other ordnance assignment is the ability to play in a team so necessary. How Ordnance Service functions in the combat zone will be presented in another article.

The Problem of Vision From Tanks

A Basic Requirement Which Still Demands Solution

By Robert J. Icks*

OF all the problems relating to the development and use of tanks, the problem of vision easily ranks first. Designers in many countries have made remarkable strides in reconciling thicker armor with only slight increases in weight, in increasing speed and maneuverability, in improved suspension systems, not to mention great advances in ventilation, stability of platform, and freedom from mechanical breakdown. It is not surprising that the problem of vision has apparently been left as the last to solve since it is the most difficult. From time to time attempts have been made but there has been little in the nature of consistent effort as has been the case with other refinements of design. All the advances, mechanical or otherwise, place us but little farther ahead of the tanks of the World War period from a tactical standpoint since modern tanks are as shortsighted as their war-time predecessors. Strategically, of course, the modern tank is a great advance, but tactically, the modern tank will still be obliged to grope about waiting to be hit. From this latter standpoint, the other improvements that have been made will be of relatively little value. Many of the improvements have been the outgrowth of a natural development process but others have been forced by the demands of enthusiasts who seem to have overlooked the basic weakness of this weapon.

The development of the modern tank is causing a revision of offensive and defensive tactical doctrine but this revision may prove to have been a dangerous basis for future wars. In other words, tactical doctrine formulated in peacetime when vision from a tank is more open and not dangerous to crews may prove entirely inadequate unless steps are taken by tank designers toward improvement in the means provided for tank vision under battle conditions. Strategically, a tank can operate with the driver's head compartment door open and with the commander's head entirely outside the tank but tactically this will be impossible. In action, the crew is walled in and practically blind. High speed in action will seldom be possible without disaster.

The problem is acute and one that will require the greatest talent in designing. It may never be completely solved but it is worthy of much more constructive thought than it has yet received.

THE means of achieving vision from tanks thus far may be subdivided into three groups: (1) direct, (2) interrupted, and (3) indirect.

In the first class comes, of course, the peep slot in its several forms, the most common of which is the long narrow cut in the armor. Behind the slot is usually a head protection pad against which the head is braced in order to compensate for and protect against the motion of the tank. The view given under normal conditions is good but necessarily limited. As an example, the driver's vision through the front peep slot of the new Christie tank begins twelve feet in front of the tank. With the compartment doors open, he is able to see to within four feet in front. In the Mark VIII tank the peep slots are larger openings in the armor behind which plates with apertures of various sizes are pivoted. One opening, which could only be used momentarily in action, is as large as the outer slot, another position of the plate consisting of a number of small holes through which vision is had when under fire.

It must be pointed out that a very real danger lies in any vision device of the direct type. Bullet splash, consisting of fine particles of metal melted through the heat of impact, enters into even the tiniest crevice in the armor of a tank and great quantities come through the peep slots. As evidence of what can be expected in this regard, reference is made to Fig. 2. These photographs were taken at the Tank School during the course of a very interesting experiment. A piece of heavy paper was stretched behind a peep slot on a 6-ton tank and then several rounds were fired against the armor with a service rifle, not one of which struck the peep slot itself. Nevertheless, the paper behind the slot was badly torn, indicating the entrance of a great deal of bullet splash. The consequences to human eyes are apparent. Indeed, it is reported that fully 50 per cent of the wounds incurred by tank personnel during the World War were eye wounds.

Goggles of shatter-proof glass have been tested and found wanting in several respects. Bullet splash places a smear on all glass soon rendering goggles ineffective. At the present time most armies are using removable plates of so-called triplex glass of the bullet-proof variety. Triplex glass, as is well known, is the shatter-proof glass coming into common use for automobile windshields. It consists of two outer layers of plate glass with an inner layer of a cellulose material. Through an elaborate heating and pressing process these are welded together. The kind used to ward off bullets consists of five or more laminations and may be an inch or more in thickness. Some varieties have turned aside machine gun fire at fifteen yards but the transparency is destroyed after such treatment. However, to back up peep slots it is very effective. The plates are made removable and a supply of spares is carried since the glass may become chipped or bullet splash may smear it too badly to remain transparent.

In the new Christie tank, the arrangement of the driver's front peep slots is such that the bracket which holds the head protection pad and bullet-proof glass is movable. In its upper position the glass covers the peep slot. When the bracket is lowered the slot is covered by metal.

OF the interrupted types of vision devices, the stroboscope is the outstanding example. The French have been the leaders in the development of this device as, indeed, they have been the leaders in the solution of the problem of vision generally. The stroboscope thus far has been practicable only for the larger tanks. On the French heavy tanks,

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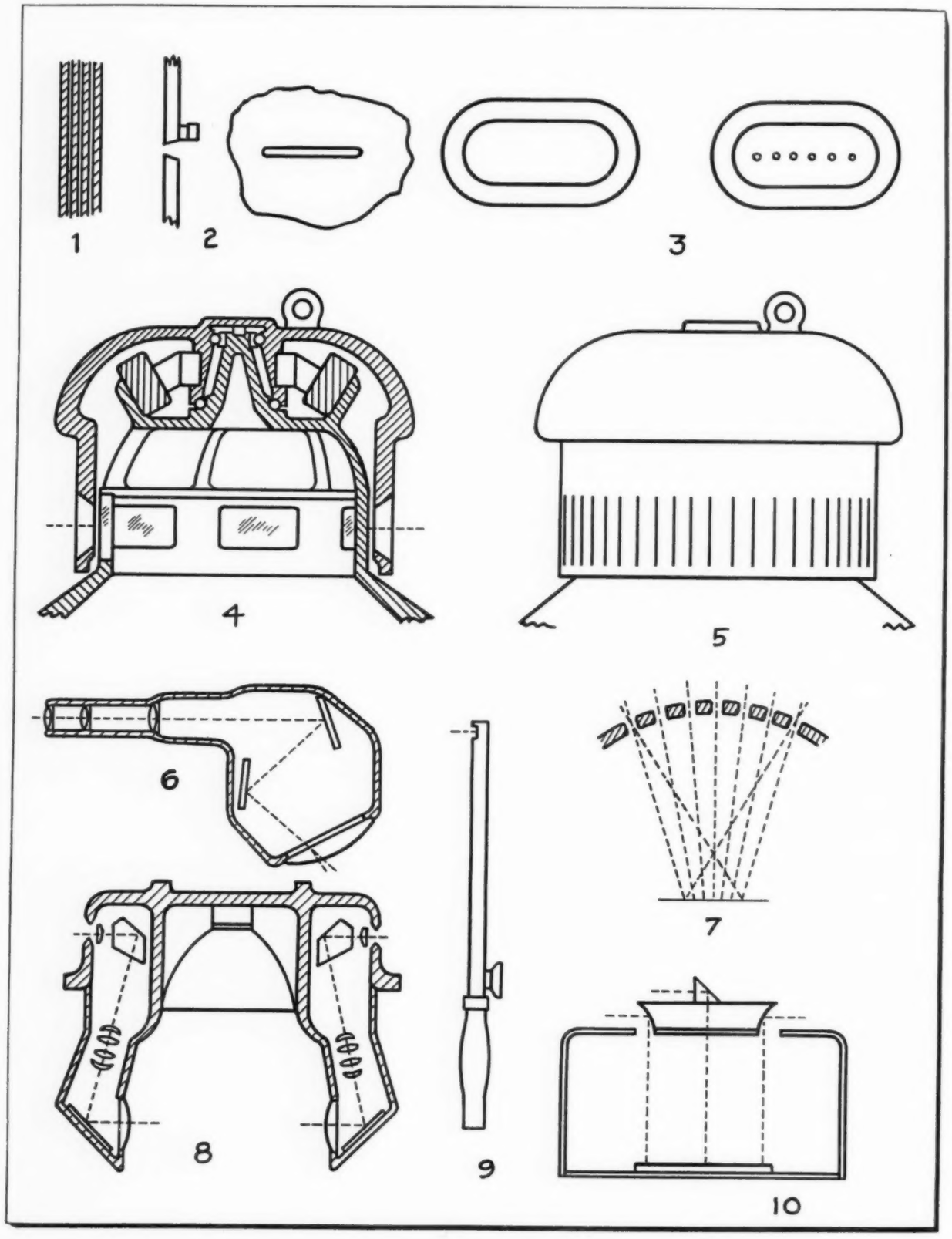


Fig. 1. Tank Vision Devices.

1. Bullet-proof triplex glass. 2. Ordinary peep slot. 3. Peep slot of the Mark VIII tank. 4. Interior arrangement of French drum stroboscope. 5. Exterior of stroboscope. 6. French géoscope. 7. Slot arrangement of new French stroboscope. 8. Goerz tank periscope. 9. Mark VIII hand periscope. 10. Karnes omniscope.

the Chars 1C and 3C, two are employed. It is a well known optical principle that the human eye can separate only a few rapidly moving images. Our motion pictures are an example, as is the effect of passing a picket fence rapidly. The images are retained on the retina of the eye so that one image blends with the next. The stroboscope works on this principle. There are several varieties, known as the drum, the cone, and the disc. The first consists of a slotted cylinder revolving at about 350 r. p. m. about an inner cylinder with larger openings, giving hazy vision of 360°. This was the type tested on the Mark VIII tank a few years after the World War and then discontinued. Later the French made

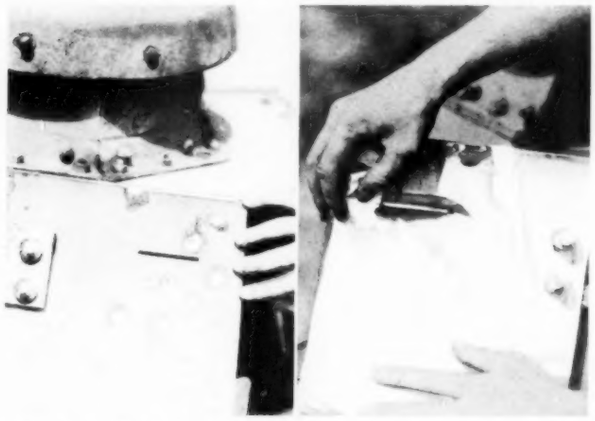


Fig. 2. Left: Impact of Cal. .30 Service Ammunition (Note that no Shots Struck the Peep Slot). Right: Effect (on Paper Stretched Behind Peep Slot) of Bullet Splash from Shots Shown at Left.

improvements which gave depth of vision or relief. This was done by cutting the outer slots in nine groups of seven each, each group converging to the center of the plane of vision. Bullet splash is a severe hazard even with stroboscopes and the French now use triplex glass on the inner openings.

The cone type of stroboscope is usually used by the driver. The slots are cut radially in the cone giving better vision to the right, left, and down. Because of the shape of the cone the angle of impact is such that the driver is protected to a great extent from fire and bullet splash is reduced but not completely eliminated. This type is reported to exist on the newer Italian Ansaldo tank. The disc type is almost exactly the same except that a plane surface is presented to bullet fire. Triplex glass is a necessity in this variety.

THE original British Mark I tank used a periscope with glass prisms behind the eyeslits. The danger from breaking glass was later removed by substituting metal mirrors. The device was found to be faulty and was so little used by the crews that it was finally removed altogether. There was little advantage to be gained, as the field of vision was curtailed by its use and the crews risked the dangers of eye wounds for the slightly better view afforded by the plain peep slots.

Later, the British relied for a broader view of the terrain on the tank periscope like that used in the Mark VIII tank. This consists of a long narrow cylinder with an aperture at the top and an eyepiece at the base, held by a long wooden handle, and pushed through an opening at the top of the tank. The field seen through the cross hairs in the periscope is rectangular in shape and is exceptionally clear. Thus far it is one of the best devices developed except that it must be held by hand and gives vision only in the direction in which it is held.

Periscopes are used in other countries also. The Italian Fiat 2000, a heavy tank, has a periscope made an integral part of the tank just above the driver. As it is immovable, there is considerable dead space in front of the tank, a fault which most devices of this nature possess.

The Goerz tank periscope, the invention of an Austrian, is a development of recent years. It consists of a dome in which there are arranged 24 prism systems. Twelve of these are arranged so that all-a-round vision is secured from 12 large eyepieces. The eyes are held about ten inches away from these. The whole system can be revolved through about 15 degrees to replace damaged prisms and to bring the entire second set into use while this is being done. The images are somewhat dark as the large eyepieces absorb a great deal of light but as a whole, the device is fairly effective. Its chief disadvantage is its cost.

Another indirect vision device is the French géoscope. The sketch shows the type used for side vision. One of its chief claims is the fact that the eyes are not endangered in any way and another is that vision from the large lens is not critical since it is clear from five to thirty inches away. Basically, it consists of a lens and mirror system reflecting an image through a large receiving lens.

One of the most recent inventions is an American instrument known as the Omniscope and invented by Maj. James C. Karnes, Ord. Res. This interesting device is on the order of the camera obscura but presents two images on a horizontal screen. A circular image is collected by a ring-shaped reflector or prism presenting a parbaloidal receiving surface and passed downward to the outer edge of the circular screen. This image covers 360 degrees. The right angle receiving prism can be moved in any desired direction and casts its repeat image on the center of the screen. In addition, provision is made for a repeater and reference line to be operated in connection with a gyrocompass for laying and following a prescribed course. The whole is mounted on a gimbal to compensate for the position of the tank when desired by the observer. The right angle auxiliary prism may be replaced by a hemispherical prism for the detection of aircraft and in signal communication. The device is ingenious but the outer receiving prisms are vulnerable and would require some adequate form of protection.

With most, if not all, of the indirect types of vision appliances the motion of the tank causes a distorted, blurred, or rapidly shifting image. Moreover, most of them are expensive and require considerable protection. The interrupted types are quite satisfactory in their way but the best of them are suitable only for the larger tanks. Perhaps direct vision from peep slots protected by shatter-proof glass must remain for some time to come as the most practicable solution, unsatisfactory as it is. Until a real solution is made, tanks must operate far below their possible combat efficiency. Whatever the solution, dust and bullet splash will be found the greatest enemies to overcome and yet, the ones most vital to the safety of the crews.

All in all, there has been nothing made public that would indicate a satisfactory solution by designers of any country.

The Chinese Fortifications at Woosung

One of the Antiquated Guns at Woosung which Withstood Aircraft Attack and Naval Bombardment.

Outpost Defences of Woosung which Escaped Enemy Fire Until Compelled to Bow to Superior Strength.

Scenes in the War Zone at Shanghai

The 31st U. S. Infantry Passing Through the Streets of Shanghai to Reinforce the Marines in the International Settlement.

Chinese Soldiers with a Lone Trench Mortar Behind a Barricade Near the Commercial Press Building in Chapei.

Tactics and Matériel

Part II: Defensive Organization and Method

By General M. J. Challéat*

IN discussing liaison between the infantry and the artillery in the attack and in order to clarify this part of my article, I shall commence by defining certain terms. I shall use the following terminology:

Infantry Accompanying Weapons are simply infantry guns, infantry mortars, small caliber guns or portable mortars assigned to infantry regiments in the same way as rifles, grenades and automatic weapons.

Artillery of the Close Direct Support: A small artillery unit placed *temporarily for a well defined mission* under the orders of an infantry unit not having any organic artillery, which is the case in most armies of the units smaller than the division. This artillery of close direct support would be furnished by the divisional artillery only on the orders of the divisional commander.

Artillery of Direct Support: A fraction of the divisional artillery placed under the orders of an infantry unit less than a division *for firing only,* and *temporarily for a predetermined mission.* In this way an infantry colonel who would have been assigned a group of direct support and a battery of close direct support might require firing from the first but could not move it, while he would be able to fire the second and move it also.

The remainder of the divisional artillery constitutes the artillery for general action.

These definitions are approximately those which are regulation in the French Army. The essential difference is what I call "close direct support," and in the French regulations and in others is called "immediate accompanying." The term I use has the advantage of preventing confusion and of avoiding illusions on the subject of close accompanying matériel. The other expression might cause one to think that this matériel should accompany the infantry represented, for example, by company commanders in the first line, like a dog that the captains would unleash when the birds are sighted and which they would call back again for a new opportunity. Experience has shown, however, that a portable mortar weighing only 50 kilograms in battery is hardly able to keep abreast of battalion commanders, even after its division into three loads. How then could matériel considerably more powerful and much heavier be able to keep up with company commanders in the front line? As I shall show the matériel of close direct support must have particular qualities to fulfill its mission properly.

To formulate these it is desirable to discuss the eventual needs of support which the infantry may encounter in the course of its advance. The infantry may be stopped by fire coming from emplacements more or less visible, some without overhead cover, but sheltered, some armored and immovable like machine gun shelters, or armored and mobile like tanks. These are the targets which the attack *must destroy or at least neutralize in the minimum time* so that the dash of the attack may not be diminished. On those we shall distinguish targets with small dimensions, well defined as emplacements, both with and without cover, fixed or mobile and targets which are not easy to see on more or less extensive areas. The former are visible generally only from very short distances. In fact, they usually, if not always, consist of single machine guns which only reveal themselves at the last moment. It is not easy to study the ground when forced to lie down under their fire in order to discover the extremely small object which is stopping the attack. If, however, the target can be discovered only a small number of accurate and well adjusted rounds are needed to overpower it. Consequently, the infantry with its mortars and its small guns in a minimum time can carry out such firing for which it has available sufficient ammunition. Again, even with excellent glasses such small objects must be close in order to be seen and communication must be rapid and sure with the matériel if quick and certain action is desired. Artillery, even of close direct support, which in principle cannot operate in the area of battalion commanders, since a matériel weighing about 50 kilograms has difficulty in keeping up, would by no means be able to obtain the result as quickly as the infantry guns or mortars. For one reason a telephone line would be needed by the observer and, in addition, even assuming that this line exists and functions with certainty, or again that a light and trouble-proof wireless apparatus is available, the preparation of fire on a target which is almost a point, invisible from the vicinity of the weapon and very difficult to designate from a distance, would always be a long operation and rarely accurate. Under these conditions the adjustment of fire on the target would generally be laborious and slow.

Zone fire must be used against targets difficult to see and this necessitates, even if relatively restricted, a consumption of ammunition out of proportion with the immediate supply at the disposal of infantry regiments. Depending on the extent of the area to be covered, recourse must be had to an artillery rather well supplied with ammunition and one which can be more or less easily supplied. The greater the size of the area however the greater the number of guns needed to fire the necessary ammunition in a reasonably short time. Now, the closer an artillery approaches the front the less numerous it becomes (the difficulties of advancing and of finding cover) and the more difficult becomes its supply. Consequently, an artillery located more or less to the rear must be used. If the communications function well, one or two kilometers withdrawal relative to the observer is of slight importance. The firing can be adjusted as well and as quickly on the zone to be covered. But no matter how effective the system of communication may be, it is subject to failure either from inherent defects or as a result of hostile fire. At such a time delays may be caused that may ultimately compromise the success of the attack. Con-

*General de Devision (Cadre Reserve) French Army. This article, prepared especially for ARMY ORDNANCE by General Challéat, is translated from the French by Maj. Donald Armstrong, Ordnance Department, U. S. Army.

sequently, the situation would be much improved if in the most unfavorable situation, for instance where the only communication available is by runners, matériel would be available so close that with this means of communication it would not require more than about 10 minutes at most to go from the observer to the matériel. This would be the case in general if the available guns were located about in the echelon with commanders of infantry regiments. From this point of view a small gun with a flat trajectory and a light projectile (about four kilograms) and with a range of about four kilometers, consequently, very light and taking but little room, would evidently be extremely useful in fulfilling the mission of close direct support on most ground. In spite of these qualities it would not be desirable to attempt to cover more than one or two hectars in view of the difficulties of ammunition supply in the areas where it would generally be used. To cover very extensive areas it would therefore be necessary to call on the mass of the divisional artillery with which the liaison might become precarious during the battle. For this reason zone firing prepared in advance (the method of the preëstablished plan) is much in favor, for only a simple signal from the infantry is needed to start it. Firing, which would be required outside of the preëstablished plans, could be executed rapidly only if communications functioned well. If communications failed, a very long delay might occur between the request for the fire and its execution. In order to partially prevent this serious defect, I have recommended the special matériel for close direct support which has been just discussed.

It should be noted, moreover, that when the zone is very extensive, as has been shown in the discussion of the offensive fire power of the artillery, it is necessary for effective fire on the area to expend large quantities of ammunition. This ammunition consumption is calculated for firing on horizontal terrain. It would be necessary to multiply these figures by the coefficient of the slope in firing on counter slopes, i.e., they must often be doubled and occasionally tripled or quadrupled. It is true that the use of reduced charges may enable us to decrease largely the coefficient of the slope. But no matter how we regard the infantry and the divisional artillery operating in good liaison, the destruction of the enemy's automatic weapons, when they are sheltered in holes or in portions of trenches, always requires much time and ammunition. And the experience of the World War showed that the destruction was never complete. Consequently, it should not be surprising that one of the most brilliant French artillerymen, General Estienne, impressed with the difficulties encountered by his arm in silencing with certainty and completely those weapons most dangerous to the advance, should have been the promoter of the assault artillery, now called "tanks," which we shall discuss later.

I NOW come to possible improvements in fire power and in liaison during the advance. With respect to armored units, as we have just seen, the offensive fire power of the actual infantry and artillery armament reveals its insufficiency especially against the automatic weapons of the defense. For the same reasons, the same situation exists in attempting to destroy isolated antitank guns which are particularly easy to conceal if they can be emplaced in flank positions so that they do not reveal themselves by their fire, except at the decisive moment. These defects must be remedied.

(a) *Destruction of Automatic Weapons.* These weapons cannot be seen for the most part except at very short range, especially as they fire from the flank and are generally not located in the zone of action of the troops whose advance they stop. In order to get at them there is actually no better method than the tank, the utilization of which will be discussed under the conditions indicated further on.

(b) *Destruction of Antitank Guns.* The general use of tanks has met a dangerous opponent in the antitank guns which are capable of stopping them at short range *with a very small number of rounds* provided they themselves do not instantly come under the effective fire of a specialized artillery which might be called *the artillery for instantaneous support of tanks.* This term is used in the sense that such artillery must be able to hit a target between ranges of 1000 and 1500 meters without any fire adjustment, in other words, instantaneously as soon as the target appeared. The tanks and this specialized artillery would be combined organically in proportions to be determined in the same unit which might be called the "armored regiment." Such an organization might operate in the following way: after the reconnaissance of the chiefs both of the tanks and of the artillery of instantaneous support directed by the regimental commander, both types of units would take cover, where the tanks would hold themselves in readiness to advance to the next available cover. The artillery would be placed in readiness, the front divided among the guns which would be prepared to fire immediately on every antitank gun coming into action. These guns, moreover, would be located in defiladed positions and they must be able to aim at the target by means of a periscopic sight as easily as they would aim with the natural line of sight if they were on the crest itself.

Under this protection the tanks would advance to the next cover where they would halt and await the arrival of the artillery of instantaneous support which would come up to this line as rapidly as possible. This process would continue. It would be the duty of the tanks to permit no automatic weapon to remain between two such positions. In this duty they would be aided by an *accompanying infantry* which would follow them at an average distance to be defined. Finally, the infantry and divisional artillery would come up and would occupy, and if need be, defend the ground won by the armored regiments. During the advance of these latter the artillery of the large units would carry out their habitual missions. However, the divisional 75's freed from numerous requests for direct supporting fire for the infantry, would advantageously and in large measure utilize their fire to assist the armored units in neutralizing the "gun orchards" (these "orchards" will be defined later). The very considerable area of these "orchards" would make it too costly to cover by means of heavy artillery. In addition, the divisional artillery would be used to blind the observing stations of the hostile artillery by means of smoke shell sent up especially for this purpose shortly before the attack. It should be noted in this connection that the tanks are protected against antitank guns by the instantaneous support artillery, and the quantity of smoke shell to be fired would

be much less in consequence of being adjusted a little in front of the observing stations than if the adjustment was made just in front of the advancing line of tanks.

Nevertheless in spite of the blinding of the observing stations, it is probable that the instantaneous support artillery would be exposed to firing from the defense in the vicinity of the crests and cover where it is obliged to stop. This artillery must consequently be armored in front against percussion shell of the light artillery and at the rear and on the sides against shell fragments or against armor perforating bullets fired at a range of a few hundred meters.

From the point of view of organization the armored regiments might constitute a general reserve that the high command would distribute in variable proportions among the divisions charged with the attack.

MY next topic is the consequences of the improvement in armament and in liaison during the advance on the value of the method of the break through.

In order to secure from the "break through" the essential effect of surprise necessary to obtain results of value, and a decisive result in case of its success, there must be available armored regiments and rapid means of transportation, sufficient to bring up secretly in one night, or at most two, everything that is needed for the sudden "break through" without preparation. From this point of view it seems desirable to insist on the necessity of armored regiments. If it seemed desirable to do without these and to be satisfied with artillery preparation to clear the way for the infantry, it is easy to see that surprise would be very difficult to obtain in the presence of an enemy the least bit watchful. In fact, it is sufficient to consider only the opening of lanes for the infantry in a simple barbed-wire entanglement formed of three lines each 15 meters thick. Assuming the proper distance between lines, each line would be treated independently of the others from the point of view of firing. Estimating 1000 rounds on the average from the light artillery to open a lane in each line and counting on four lanes per battalion, for an attacking division having four battalions in the first echelon a consumption of 48,000 rounds of light artillery shell for this single mission ($3 \times 1000 \times 16 = 48{,}000$) would be required. Firing 400 rounds per hour per battery which was the maximum rate of fire allowed in 1918, the entire light artillery belonging organically to the division (36 guns in general) would be needed. Moreover, approximately thirteen hours of preparation would be required exclusively for the purpose of cutting the lanes in the barbed wire entanglements, and four or five days would be needed with the amount of transportation that was available in 1918, to bring up the ammunition necessary for this firing alone.

To obtain any effect of surprise at all it would consequently be necessary at least to triple the light artillery of the attacking division. Even then four hours of artillery preparation would be required. It is true that it would be possible to increase the rate of fire but it seems difficult to quadruple it without damage both to the recoil systems and the guns even assuming great improvements from this point of view. In addition, it is necessary to consider the fatigue of the gunners needed to bring up such a tonnage of ammunition at such a rate without any rest. Finally from the industrial point of view the operation would be extremely costly with rather limited chances of success, in consequence of the absence of the requisite surprise in the advance. Considering only the firing against the barbed wire entanglements, and estimating that each lane 25 meters wide and 15 meters deep necessitates the expenditure of 1000 rounds of light artillery ammunition, it is evident that the attack expends at least 25 times more money in ammunition than the defense expends for barbed wire. In fact, if the price of a square meter of entanglement is one-tenth the price N of a light artillery shell, a lane covering 375 square meters (25×15) would have cost the defense $375 \times \frac{N}{10}$ while the cost to the attack would be 1000 N or 26 times as much, and this excess of expenditure must be multiplied by the number of lanes in each line. These figures prove to how great an extent the cost of the matériel of armored regiments would be rapidly amortized in counting only the cost of cutting lanes in barbed wire entanglements without even considering what it would avoid in losses in man power.

I shall assume then that the process of the "break through" is anticipated only with the assistance of numerous armored regiments and with a very extensive motorization for the rapid transportation of the other units. But can it be hoped that under these conditions the "break through" of the first position can be decisive? Certainly, if the operation succeeds, it can give extremely valuable results. Will they be decisive, however? Not if the enemy wishes to defend himself to the limit, energetically, on successive positions. The organization of a defensive position can be made very rapidly if the precaution has been taken to supply the necessary mechanical equipment. In the United States more than anywhere else excavating machinery is available for all kinds of terrain, which with a single operator can dig per hour 30 meters of trench one meter wide and one meter deep in ordinary ground. With such machines and 30 to 40 mechanics, which would permit reliefs, it would seem possible in 24 hours to organize a rather strong defensive front for a division. The first occupants could then dig in more effectively and could gradually improve the initial construction especially if other machines were able to construct at least one line of barbed wire entanglement at the same time that the excavators were digging the trenches. It is noteworthy that this method of operation does not deprive the command of large numbers of troops who would be particularly needed at a critical moment.

Consequently it is evident that even with actually available perfected means of attack, which would of course suffer losses at each position taken and would finally wear themselves out, there is no hope of finishing a major war today after a single major battle won at the beginning of a campaign as was true in the time of rifles and guns with an effective range of 150 to 200 meters for the former and of 1000 meters for the latter. And this is true, even if it were possible, as certain authorities recommend, to employ the air forces not only in the manner already known at the end of the late war, but in addition, *in a special way* to make decisive the "break through" obtained *with all the actually known resources*. In order to fulfill this mission the air forces would evidently have to make their objective essentially whatever stops the advance of the troops after the "break through," and also to increase the effect of surprise.

First of all what will stop the advance after a break through the first lines? On the one hand, there is the wear and the destruction of the matériel of the armored regiments while taking the successive positions, and on the other hand there are the new positions which the defense would have organized very rapidly during the battle itself with the assistance of special machines. These positions will be difficult to break through without delay if the resources available at the beginning of the attack have become insufficient.

The wear of the matériel of the armored regiments during the operation depends on its ruggedness which will be improved more or less rapidly in consequence of the progress to be anticipated in this domain as in others. Its destruction may result occasionally from mines or traps but most frequently without doubt from the fire of antitank artillery. Against mines and traps the air service can evidently do nothing. Against antitank artillery it will be much less effective than the immediate support artillery of the armored regiments. Consequently, the air forces must operate essentially against the other obstacles which prevent the advance, i. e., against hostile troops moving either to reinforce the front or attempting to reorganize in the rear, and against machines working on the construction of new positions. These missions are in no way novel in the operations of the air forces in combat. Perhaps it would be possible to require the air forces to contribute in a considerable degree to the effect of surprise by transporting in special machines to the rear of the hostile lines special shock troops who would come into action at H hour of the attack. For this purpose it is not necessary to go very fast or very far, nor to fly at great altitudes. It suffices to be able to transport enough men at one time and to be able to land easily without special landing fields. For this last purpose, machines of the type of the autogiro invented by Mr. de la Cierva might perhaps furnish a first solution of the problem. If some day it were possible to "jump" over the hostile front with some formations of special shock troops supplied with special automatic weapons, well supplied with ammunition and designed moreover to fire enemy cartridges, it is easy to conceive of the anguish which would destroy the morale of the defending forces when they heard behind them heavy musketry fire at the same time that they witnessed a vigorous attack from the front.

Consequently, if it is desirable to adhere to the method of war based on the "break through," the "jump" over the hostile front is a problem the solution of which must also be sought. The result would be all the more desirable as the special shock formations in question might be charged with particularly important missions against certain vital organs of the defense. Perhaps then the "break through" might become a very advantageous method of war. But before this happens the question should be studied to determine whether the air forces could not, without aid from the other arms, with the land forces remaining on the defensive, cause the enemy to sue for peace. I shall now examine this question.

WE now come to a discussion of defensive on the ground and aerial offensive. In this method of carrying on war, the principal effort is made over the hostile front where the "break through" would not be attempted until the success of the principal effort indicated that such an undertaking would be opportune. A decision must be reached as to whether or not such a method could be carried out more rapidly than that of the war of accelerated attrition which I have examined above.

First of all what should be the objectives of the air forces, assumed in this case to be the principal arm, in order to try to obtain a rapid and decisive victory—the kind of victory which was obtained prior to 1914-1918 in wars, exclusively on land, by the application of the Napoleonic principles? Obviously, the choice of these objectives should be determined by these same principles, i. e., the objectives should be the communications, bases of all kinds, and the morale of the enemy. The objectives consequently would be the most important and vital points of roads and railways, factories, and, unfortunately, cities, as the morale of the nations apparently could be reduced most easily by the attack on large centers of population. As a matter of fact, the air forces in the future will probably be able to attack these objectives with devices much more effective than those known in the last war. No matter how terrible aerial bombardments may become it is doubtful if, by themselves, they would suffice to cause the capitulation of a people who value their independence above everything else. Against aerial bombardments, moreover, it is possible to construct shelters in the cellars of the most solidly built houses and to supply them with collective gas filters, to supply individuals, obliged to be outside during attacks, with gas masks, without mentioning the active defense by pursuit planes, by antiaircraft artillery, and in certain of the more vital places, by captive balloons. In case of necessity the populations of the very large cities could be distributed to a certain extent in the country. Bombardments of cities therefore constitute a means of applying pressure but are not a means for securing a decision.

THE destruction of the factories from which the air and land forces obtain their supplies and the destruction of bridges, culverts, etc., on the roads serving them might have far more immediate consequences, but the airplanes charged with such a mission would be opposed by an effective antiaircraft defense. In this connection it is noteworthy that in a war of this kind, everything being equal, nations might be favored in some cases by the possibilities of finding in neighboring territory factories capable of substituting for the factories which might be destroyed.

It appears then that if a very strong air force might contribute to the acceleration of a war of attrition it would not be able to prevent it. Moreover, it would not make it possible to do without an army sufficiently numerous to keep the nation from being invaded by hostile land forces whose entry into action must of course be anticipated.

Students of war have consequently come to the conclusion that if in all cases a war of attrition must be expected the best solution would be to try to carry it out in the most economical and the most tolerable fashion. The method of warfare which is at present being much discussed in the newspapers conforms to this idea and I shall now take it under consideration.

From the preceding considerations it does not seem possible, no matter how perfect the matériel that may be used, to break down in a few weeks or even in a few months the resistance of a solidly armed people, decided to defend their liberty to the last. If the possible enemy were convinced

of this, in advance, war would become less frequent unless the "warlike spirit" of a potential enemy not having been "disarmed" he might reason in the following way: If it is assumed that future wars cannot be ended like those of former days by a major victory at the outset, exploited without delay by an energetic pursuit of the disorganized hostile forces and by the occupation of the enemy territory, i. e., if a rather long war of attrition must be fought, why not attempt to carry it out from the beginning on hostile territory not yet provided with all its means of defense and all the personnel needed to put its defenses in action? If successful there would be the advantage of all the ground won, and in this way, at least all one's own cities would be protected from bombardment by hostile artillery, even if aerial bombardments are not rendered much more difficult by this action. Now a surprise invasion has more chance to succeed, if the enemy guards his frontiers with less care and if it is possible in addition to forestall his movements by having forces constantly ready, more numerous and better trained than his and with all the necessary means of rapid transportation. It would seem that this is actually a situation concerning which a peaceful country whose only thought is to prevent an invasion should reflect very seriously. The method of war of its potential enemy might, in fact, consist in organizing its army as will appear later on. This method of operation, it should be noted, would not consist, for the nation which practices it, of a "poker party" as it has been incorrectly called in my opinion, but would be a real modern method of warfare. This does not weigh the relative merits of the "professional army" and the "nation in arms," but simply means the rational utilization of the forces of a country to realize, in case of conflict, above all "the prior conquest by surprise of those political, economic or strategic objectives concerning which the League of Nations will deliberate eventually, but too late, leaving the nation which will have seized them the advantage of having them in its possession."

Whatever happens, there is reason to think that in the face of a people which has made up its mind not to disappear, the method of the sudden attack would end after a certain time either by the method of the "break through" or by the purely defensive method which will now be discussed.

DEFENSIVE on the ground and in the air is a method of warfare adapted to peaceful nations which cannot conceive of taking the initiative in hostilities required by the method of the sudden attack. It evidently has serious disadvantages, particularly that of exposing the country which adopts it to very serious risks, without causing appreciable danger to the enemy. However, it results in the moral advantage of corresponding to the desires of the nation and of favorably influencing world opinion. Certainly this last point of view is not absolutely negligible. For, assuming that the results obtained by this method come up to the expectations of the defense, i. e., that the enemy's efforts will be shattered at the frontiers, the war would necessarily be ended by more or less rapid attrition during which intervention, for instance by the League of Nations, might fortunately be attempted. It should be noted, in passing, that the probable success of such intervention would be greatly advanced if the aggressor nation knew, with its sudden attack a failure, that it would still have enormous efforts to make to obtain a success which would nevertheless always be uncertain. The ability to prove that one is not the aggressor is moreover of capital importance. From this point of view the League of Nations might perhaps play a still more important role in maintaining peace if it were possible to establish a service of international delegates who, in the event of political tension, would take up positions of surveillance in the zones of the frontiers. From these positions they would report to the entire world the arrival of troops in such and such a region.

The purely defensive method has on the other hand the great disadvantage of costing very dearly to the defense in awaiting the shock of the attack on the frontier. Even in case of a failure of the initial hostile attack, the ruin of numerous cities and other places to a depth of at least 15 kilometers would be certain. Moreover, it would expose the country to a very great disillusionment if the aggressor nation makes a sudden attack at the beginning, when the front can obviously not be protected by all its barbed wire entanglements and trenches. In any case it requires serious precautions which will now be examined.

THE break through of a solidly held and organized front requires a considerable force. Consequently, it cannot occur without the existence of the nation in arms or the *levée en masse* and moreover only after the lapse of a rather long time after the declaration of war. If the two opponents were resolved not to attempt the sudden attack, the organization in vogue before 1914 would still be suitable. If the frontiers were defensively organized it might be hoped that the two nations mobilized on their own territories would eventually heed the intervention of the League of Nations in favor of peace. It is necessary nevertheless to anticipate the possible use of the sudden attack. And this fact must influence the organizations to be adopted depending upon the methods of warfare to be used in case of hostilities. These methods are at present four, namely: (a) The accelerated break through; (b) the offensive in the air, and the defensive on the ground; (c) the sudden attack followed either by the break through or by the defensive on the ground, and (d) the defensive on the ground and in the air. The peace-time organizations must depend essentially on the last two methods since the first two include measures to be taken some time after the opening of hostilities. I shall examine only the organizations needed to execute the sudden attack and those whose sole purpose is the defense of the frontiers against invasion with the additional precautions taken to prevent aerial attacks on the national territory.

THE method of sudden attack described above immediately suggests the organization necessary to carry it out. This organization, in fact, must be such that the attack will have at any moment and without delay at its disposal an army, at least equal in number and superior in quality to the available peace-time army of the country to be attacked. *It must be able to move* by means of reasonably numerous and rapid transportation, *in forty-eight hours or even less to the region where the surprise attack is planned.* It is obvious that a *professional army,* composed of trained men constantly ready to be entrained for the front, fulfills these requirements. All that is necessary, and this seems a simple

matter, is to supply it with the necessary means of transportation. Moreover, if its effectives are judged insufficient it could be reinforced, one might say almost immediately, by volunteers *if the country has conserved a warlike spirit.* In France, for instance, where the national will is completely hostile to war, I do not believe it would be possible to call out volunteers in time of peace to such exercises or at least I do not think that they would come in sufficient numbers, assuming moreover what is extremely doubtful that the Government of the Republic would tolerate such manifestations. Moreover, if the Government would tolerate them it would run the extreme risk of being overturned immediately by Parliament.

As regards the reinforcements to be drawn from the nation so that the army making the initial attack can retain the ground won and even extend it eventually, it seems equally easy, if the country desires it, to give them sufficient instruction strictly for defensive operations. Shooting clubs, associations for various sports, etc., can not only ensure this very simple instruction of their members, but can also give them the desired training in team work.

The sudden attack would gain the greatest possible ground in hostile territory and then it would only be necessary to complete the instruction and armament of the effectives obtained from the *levée en masse.* After the first two or three months of hostilities, these effectives and those of the professional army would merge more or less rapidly to form a formidable national army, at least as strong as that which could exist in the same country in 1914.

A country which does not want to be invaded must be able to parry a danger of this kind for its own security.

IT will be necessary to consider successively the defensive organization of the frontiers against an invasion on the ground and the defensive organization of the nation against attacks by air, the organization of the covering forces necessary to oppose a sudden attack by supporting themselves on the fortified regions and finally the mobilization and utilization of the reserves.

We stated in the preface that France does not dream of invading another country but wishes to close its doors to a hostile invasion. Consequently, in recent years, thorough studies have been made of the principles of a defensive organization of its frontiers. It is therefore natural that I should be influenced in this part of my study by what has been published in France on this subject and by the solutions which have been finally approved after long discussion in the press and in Parliament. Only the principles which have been *publicly discussed* will be stated here. There were two opposing theses; one, recommending in a certain measure forts even more powerful than those built prior to 1914; the other, preferring small dispersed works conforming to the terrain and supported by a very mobile artillery. The latter view seems to have won the day. Certain powerful works are considered necessary in certain instances, it being understood, of course, that the system to be adopted must always be appropriate to the general character of the region in which the works are to be located. For example, in a very mountainous region with few approaches, the defensive works would be limited to barring these approaches and in addition organizing in fortified regions the particularly important points where these approaches converge. In open country where the approach is easy from all directions small scattered works will be constructed with a view to realizing the maximum *defensive fire power* continuously and to a certain depth. In wooded areas, where the advance would be very difficult outside of the few roads which traverse them, the defense would be limited to carrying out the systematic destruction of these forests, in order to construct passive obstacles protected by small guard posts. Finally, in regions where a sudden attack seems improbable, it will be sufficient to determine where the defensive positions should be located, to be constructed rapidly in case of necessity. To this end mobile fortification parks can be organized comprising machines and matériel suitable for the very rapid construction of positions to be organized on the battle field.

The thesis of small scattered works is based on the following considerations:

a. From the foregoing considerations it is evident that the weapon, *par excellence,* to stop the advance, is the machine gun up to 600 meters, especially when it fires from the flanks on a terrain of uniform slope. Consequently, these works are dispersed to conform to the terrain and the necessity for not exceeding this range.

b. The machine gun must be supported by the light field gun which fires against enemy matériel and covers those portions of the terrain either not reached by the machine gun at all or ineffectively at best. (Troops resting in improvised trenches, slopes not reached by very flat trajectories, etc.)

c. Certain steep slopes will be covered from nearby positions by matériel using vertical fire.

d. Works covering considerable areas which are relatively easy to hit by the major caliber artillery of the attack are to be avoided as much as possible.

e. Systems of observation and communication must be particularly effective so that defensive fire can be opened at opportune moments, that is to say, everywhere that the enemy reveals his presence.

I have already noted briefly in speaking of the method of warfare which adopts the defensive on the ground and the offensive in the air of what such an organization for defensive preparation of the national territory against aerial attacks would consist. If I mention this subject again it is only to emphasize the fact that experience teaches us that in spite of even the best precautions a few particularly bold bombing planes will get by and will drop bombs on important targets in the interior. The only defense in such a case is obviously to make reprisals.

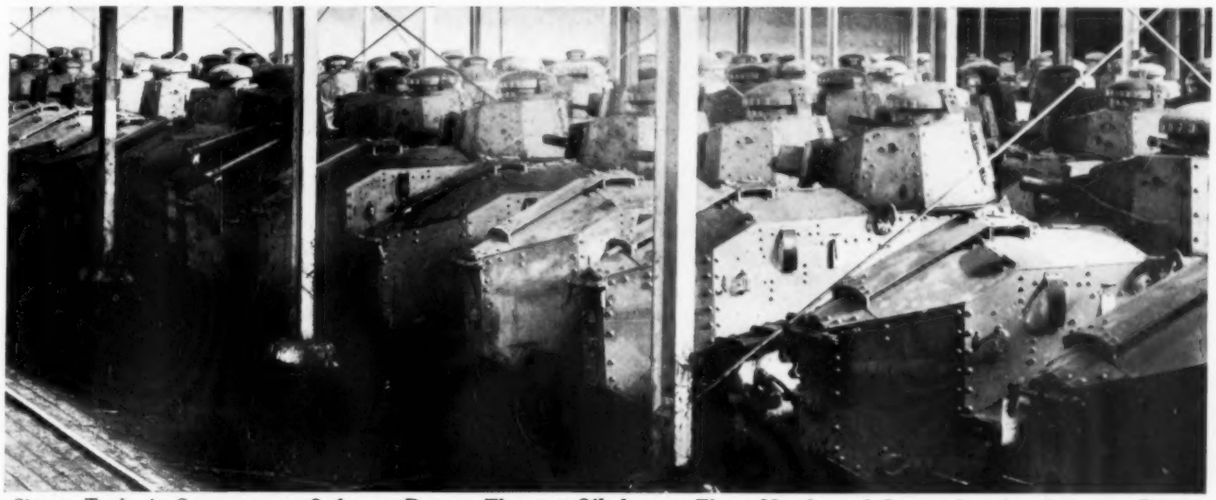
IF the preceding principles have been judiciously applied and particularly if the small works have been properly located, both in depth and along the front, taking into consideration especially what has been said above concerning the defensive fire power of machine guns and artillery, the defense will be in readiness to resist a sudden attack, *if there is available a permanent observation telephone system, if the works are at all times occupied by small contingents of troops and if the bulk of the covering forces can arrive at the positions to be defended in less time than the enemy takes to reach them.* In addition, the total effectives of the permanent garrisons and the covering troops should equal the number of troops which there is reason to fear might make a sudden attack. This equality in numbers is essential

no matter what kind of an army the defense may have. The nation on the defensive, as a matter of fact, not knowing the location of the attack is forced to prepare a defense more or less everywhere. Consequently, the effectives which it can oppose to the attack are numerically less than the total effectives of the covering force. Moreover, if the peace-time army is based on conscription with a very short period of active service, equality in numbers is even more necessary since the troops of the defense are composed in large part of young men scarcely full grown physically and whose military education is mediocre. Opposing them are troops of the attack composed of mature men, extremely well instructed from a military point of view and in the best of physical condition. It is true that fortification contributes a valuable aid to the defense, but it would not be able to compensate for too great a numerical inferiority of the covering force in the event that the sudden attack occurred before the intervals between the works could be properly occupied, the trenches dug and the wire entanglements installed. *Fortifications combined with an unquestionably too small covering force* can give a country only a deceptive security in time of peace, and will cause it great disillusionment in time of war which may influence the nation's morale most unfortunately. A fortified barrier is by no means the equivalent of an ocean or even a mountain chain which would be very difficult to cross. It is evident that the importance of a solid covering force is at least as great as that of the defensive organization of the frontiers.

AS to the mobilized army and utilization of reserves. This army would come in contact with the enemy some time after the sudden attack depending on the distance from the frontiers where the organizations were mobilized. The mobilization should take place in the different regions so that only complete units would be transported into the theater of operations. Nevertheless, it would be important to be able to reinforce as soon as possible the covering troops. Perhaps to accomplish this it would be possible to mobilize units in a somewhat varying manner, depending on the destination to which they would be sent at the beginning of hostilities. This appears possible as soon as a purely defensive method of war has been adopted, using organized and well known positions. For example, the units in garrison in the regions nearest the frontier could strengthen the covering forces without delay provided they would not await the arrival of all their reserves. The other units to be mobilized in regions more distant from the future front would be transported in the direction of the front attacked or menaced and would constitute the general reserve of the armies. The nuclei of these units might then be considerably reduced and furnished on mobilization by the active units belonging to the covering force whenever they would prove to be surplus. This personnel would thus be better trained than if they constituted permanent mobilization depots. This may not be the best solution and I give it only to show to what extent the choice of a method of warfare influences the organization of an army in time of peace (the period of active service would be determined by the requirements of the indispensable covering force, these requirements being compared with the numbers available from the annual draft, locations of garrisons, etc.), and affects the method of mobilizing the many troop units upon the outbreak of hostilities.

THIS general consideration of the methods of modern warfare shows, as ARMY ORDNANCE requested, *the influence on tactics and strategy of the most recent progress in armament*. In order to consider the question from a general point of view I have been forced to be very brief in my remarks concerning the artillery. But the conclusion should not be reached that this arm will not increase its importance on the battle field. The increase in its ranges and in the number of calibers available increases the length of its arms and the size of its fists. The wide fields of fire provided by its carriages facilitate its acting in force with tactical surprise, by means of rapid and massive concentrations of fire on various successive targets and its mobility is insured, even in case of gas warfare, by mechanical traction. Elsewhere I have noted the possibility for a numerically inferior artillery to escape the massive concentration of fire of the hostile artillery by dispersing its pieces, at the same time facilitating the concentration of its fire according to needs. In the June, 1931, number of the *Revue d'Artillerie*, I have described the very simple methods for obtaining this result in practice. This would make the counter-battery fire of the enemy a very difficult problem, even assuming that it was generously supplied with the means for aerial observation.

But let us return to the influence of the progress in armament on the methods of modern war. It is noteworthy that such progress is less favorable to the offensive than to the defensive which is able—especially if fighting in well organized positions—to resist advantageously very much greater hostile forces. This progress consequently can protect the smaller countries better than at any time in the past against the attacks of the larger nations. It will make these latter nations more circumspect in using brutal methods and will lead them to have resource more willingly in the event of discord to settlements by arbitration treaties and the League of Nations. Undoubtedly it would be very desirable for the League of Nations to have at its disposal an army sufficient to bring to reason any nation desiring to make war, but unfortunately many questions arise in connection with such a force. For example, who would be the military chief of such a force, who would designate him, who could revoke his commission, who would regulate the composition of the commissioned personnel and their promotion, where would the constitutent organizations be located, where would they maneuver, etc.? These questions evidently offer difficulties which, without being insurmountable, have been neglected up to the present time as far as I am aware. It would be desirable to overcome these serious defects as soon as possible. But in the meantime if, thanks to the progress in armament which favors the defensive, the peacefully inclined peoples are enabled to doubly lock their gates at the first alarm, it will facilitate the action of international justice in making more circumspect the warlike peoples who perhaps will prefer then to have recourse to judges and will observe their decisions rather than risk the danger of being forced to do so, after having failed in their attacks against these impassable barriers. Then there will be hope for the maintenance of peace that no country desires more sincerely than France which in the past has particularly suffered from invasions. (This concludes General Challéat's discussion of Tactics and Matériel. Part I was published in the November-December, 1931, issue of this Journal, Vol. XII, No. 69—Ed.)



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Keeping Our Weapons Ready for Action

The Battle Against Deterioration in an Ordnance Supply Depot

By W. F. Vander Hyden*

DEPOTS from which ordnance is supplied to the various components of the Army are classified as ammunition and general supply depots. Because of the danger involved in handling explosives, ammunition is stored and maintained separately. General supply depots, however, usually store and issue small arms ammunition as there is slight danger attached to this type, and it resembles other items of ordnance in that it is issued to practically every organization, post and station in the Army. The purpose of this article is to describe briefly the activities of a general supply depot in time of peace and, more particularly, the Rock Island Ordnance Depot as a concrete example. These activities in general consist of the issue, receipt, storage, and maintenance of a great many different types of supplies.

The depot at Rock Island is the largest and most active of the general supply depots in the United States. It maintains a stock of forty thousand items, valued at more than two hundred million dollars. This stock consists of mobile artillery matériel, including guns, howitzers, carriages, recoil mechanisms, and auxiliary vehicles; all types of small arms, automatic arms, and small arms ammunition; tanks, tractors, and trailers; cleaning, preserving, and target material; optical instruments, hand and machine tools, and miscellaneous hardware; and spare parts and accessories for these articles. The depot buildings have thirty-seven acres of floor space and consist of forty-six permanent warehouses.

Shipments and receipts per year amount to forty million pounds and involve the handling of about one thousand cars. This requires an up-to-date traffic section similar to those found in commercial plants and the activity of this section results in considerable savings to the Government as a result of properly routing and classifying shipments. The Fifth, Sixth and Seventh Corps Areas receive all ordnance supplies, except ammunition, from this depot. In addition, certain items manufactured at Rock Island Arsenal, such as hydro-pneumatic recoil mechanisms, target material and spare parts for tanks and tractors, are supplied by the depot to the entire United States and the overseas departments. Approximately six thousand sales of obsolete small arms and parts therefor are made annually to individuals and quasi-military organizations in all parts of the country. This service is handled on a twenty-four hour basis very much in the manner that orders are filled by mail order houses.

Modern methods are employed in filling requisitions and in controlling stock, and it is safe to say that these methods are comparable to the best practice in large commercial establishments. A machine system of stock accounting is used, whereby sufficient copies of shipping tickets and all entries required on stock cards and stock-control cards are made in one operation. A stock-control section operates to make timely demand for the replenishment of stock by transfer from other depots, or by securing funds necessary to procure commercial items or to manufacture non-commercial items in the Arsenal shops. Trained personnel is engaged continuously throughout the year in making the required annual inventory. For a time after the World War, errors in stock account found on inventory were considerable but in recent years these errors have been only about five per cent. The property section systematically checks stock to insure the disposition of items as they become obsolete or unserviceable. Due to the large stocks left by the World War and the changes made in equipment since then, this activity has assumed considerable importance. These items are disposed of either by sale as salvage or by exchange for new equipment. During the past two years one hundred and seventy-five thousand dollars worth of new tractors have been secured by the exchange of unserviceable war-time tractors and surplus parts. At the present time

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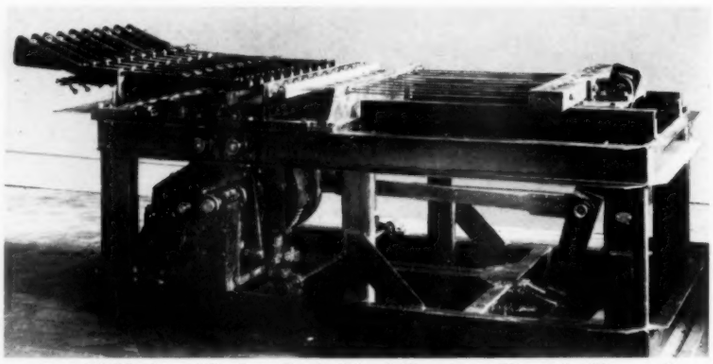
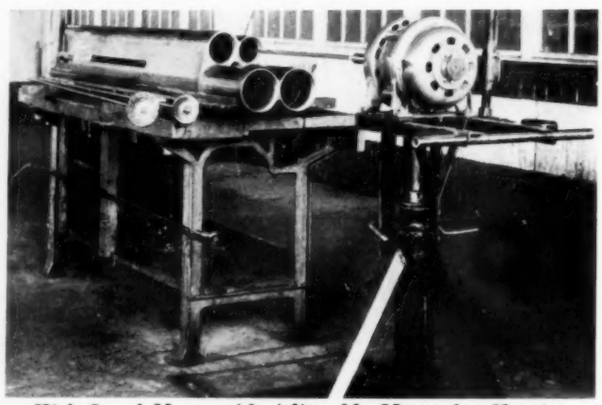
fifty million rounds of deteriorated small arms ammunition are being broken down, after which the resultant scrap metal will be exchanged for new powder.



Special Machine Used at Rock Island Depot to Clean the Bores of Service and Semiautomatic Rifles and Machine Guns.

ALTHOUGH the forty thousand items in stock are active in that they are shipped to and received from the field, only a small percentage of each item is active, the bulk of the item being in the nature of a war reserve. This necessitates the storage and preservation against deterioration for a period of possibly twenty or more years of vast quantities of matériel, which is a complication not found in commercial plants. To insure proper inspection and maintenance as well as conservation of storage space, a large amount of this matériel, especially guns and their carriages, is stored partially disassembled. However, due regard is given to the desirability of having stores in the best possible shape for prompt issue in an emergency.

Special racks have been devised for storing recoil mechanisms, guns, howitzers and other articles in order that individual items may be maintained or removed from piles without disturbing the balance of the pile. The guns and howitzers are properly staggered in the racks so that the breech block may be opened and the tubes cleaned of grease, inspected, and reslushed without removing them from the racks. In storing gun carriages with spring-type recoil mechanisms, sufficient springs are removed to prevent permanent setting of the spring columns. It has been found possible to store some hydro-pneumatic recoil mechanisms assembled ready for use, whereas in the case of others it has been necessary to store them disassembled with the bores properly slushed and the recoil rods packed separately in special crates. Likewise in the case of gun carriages, some types can be stored assembled, while with others it has been found necessary to remove wheels and axles to insure preservation. All vehicles equipped with rubber-tired wheels are blocked to remove the weight from the tires, and all spare wheels equipped with rubber tires are stored in dark storage. Automotive vehicles and spare motors are stored so that the motors can be turned over by hand at periodic intervals. All wooden articles, such as wheels, gun stocks, and tool handles are stored where they can be readily inspected to detect deterioration by insects or fungus growth. Specially constructed rooms or inclosures within the warehouses are provided for the storage of pistols, revolvers, field glasses, and other articles which experience has shown it is particularly necessary to guard against theft. In the storage of optical instruments, effort is made to maintain a constant temperature to prevent condensation of moisture on the optical elements. Careful attention is given to the storage of brushes, flags and helmet linings to detect and prevent deterioration by moths. In fact, practically every item which must be stored for many years until needed in another emergency requires special attention in selecting the proper method of storage.

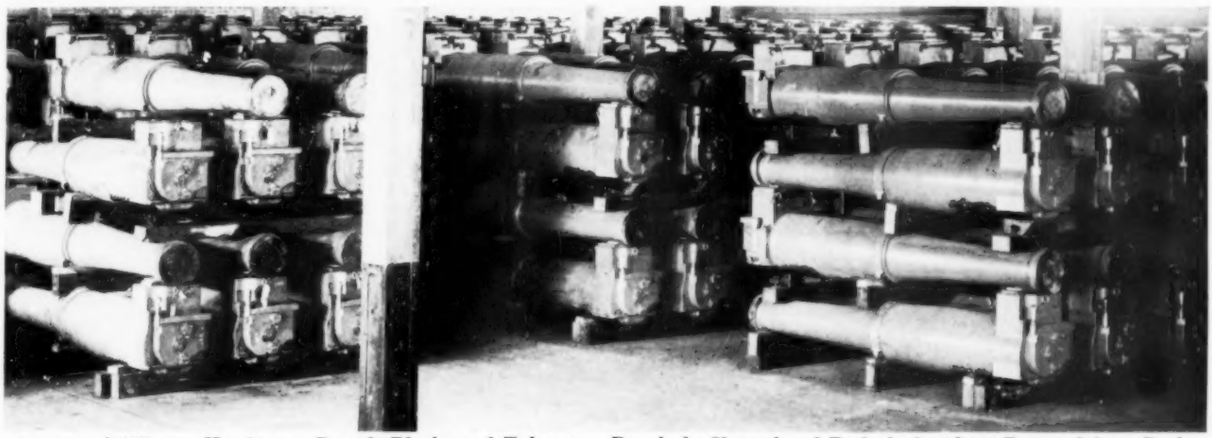


High Speed Motor with Adjustable Mount for Cleaning Recoil Mechanisms.

IN the battle against deterioration, various percentages of all principal items are annually disassembled, cleaned and carefully inspected. As most of these pieces were overhauled or reconditioned for storage over a period of years, care is taken to insure that the inspection covers specimens from the lots of each year's work. In making these inspections, use is made of the trained personnel available in the manufacturing shops of the Arsenal. The results found are carefully recorded and later used to furnish the Chief of Ordnance with an annual report which gives detailed data as to the condition of all principal items in store. The Chief of Ordnance is also furnished with an estimate of the funds required to place in first-class condition those items found to be deteriorating, together with a recommended priority schedule, as the funds available are never sufficient to accomplish all of the work desired. The items most difficult to preserve properly in storage are the highly finished bores and rods of recoil mechanisms, and the bores of rifles and cannon.

The bores of recoil mechanisms are manufactured to extremely small tolerances with highly polished surfaces and are usually well over forty inches long and, in some cases, are less than two inches in diameter. Very slight rusting or pitting of the surface of the bores or roads in the hydro-pneumatic mechanism results in oil and air leaks which render them unserviceable, whereas pits of any great size usually necessitate the scrapping of the entire mechanism. This rusting in the bores of mechanisms is not necessarily the red variety familiar to the average layman. In fact, it is not always readily apparent to the naked eye and appears to be merely a dark discoloration. For this reason, magnifying boro-

scopes with electric illumination are necessary. It has been found that the recoil mechanisms for the 75-mm. gun, French, and the 155-mm. gun can be maintained completely assembled with the service solution, if they are "gymnasticated" every three months. This gymnastication consists of releasing the reserve oil, jacking back the piston rod so that it may be inspected and cleaned at the packing seats if necessary, and then pumping back the reserve oil. This operation serves to move floating pistons and valves and break all joints at the packing.



Storage of 155-mm. Howitzers. Breech Blocks and Tubes are Regularly Cleaned and Reslushed without Removal from Racks.

On the other hand, other types of hydro-pneumatic and all hydro-spring type mechanisms can be best maintained in a disassembled condition. In this case, the cylinder walls are carefully cleaned by the use of specially constructed wire brushes and adjustable wooden revolving heads covered with a very fine grade of abrasive paper. They are then washed with cleaners' naphtha, dried, and slushed with rust preventative. The recoil mechanism is placed in a vertical position for this slushing operation and, by means of several operations with hot grease and adjustable plungers, a uniform coat approximately four-hundredths of an inch thick, free from air bubbles, is built up on the surface of the bore. In some cases, rusting and pitting have progressed to the point where complete cleaning of the bores cannot be accomplished by means of the revolving wire brushes. In this case the mechanism is placed on a revolving stand and is partially filled with an acid solution containing a proprietary inhibitor. Action of the acid is accelerated by means of revolving wire brushes inserted through stuffing boxes while the mechanism is turned on its stand so that all sides of the bore are immersed in the acid. It requires approximately twenty minutes for the acid to reach the bottom of a deep pit, while ordinary discolorations are removed in two or three minutes. The acid is drained off and the cylinders treated with an alkali solution to neutralize the acid and then filled with hot water and swabbed with a mop. They are next dried with clean cloths and finally cleaned with alcohol to evaporate any moisture which remains in the bottom of the pits. The purpose of this cleaning is to prevent the pits from reaching a depth which would necessitate scrapping the mechanism. Before assembling these mechanisms, all pits are removed by lapping to oversize. The piston rods for these disassembled mechanisms are cleaned with wire brushes and, if necessary, are also treated with acid. They are then dipped into a tank of heated grease which is allowed to set, and the rods are packed in dust- and moisture-proof boxes. It has been found that the all-important thing is to insure that the surface is absolutely clean before the rust preventative is applied if further deterioration is to be prevented. Workmen wear cotton gloves in handling highly polished surfaces during the final operations just prior to the application of the grease to prevent the moisture and acid on the hands from starting more rust.

In reconditioning small arms and automatic arms, grease is removed in a chamber which is heated to about 150° F. All grease preservative is melted off except a very fine film. The rifles, automatic rifles and machine-gun barrels are then cleaned on a power-operated machine which cleans ten at one time. They are first cleaned with naphtha and then with dry cloths, after which they are inspected. If further cleaning is required, special wire brushes are used and, if this does not suffice, they are treated with an acid solution very much in the manner outlined for recoil mechanisms. In removing the grease, a stream of hot grease is allowed to flow through the bore from an overhead tank. This method of greasing bores results in a relatively thick film over the entire surface of the bore rather than a plug of grease filling the bore as is the case when the conventional method is used of immersing the rifle in a tank. It has been found that a plug of grease filling the entire bore tends to break away from the surface of the bore, whereas this is not the case when only a heavy film of grease is used.

THE bores of field guns and howitzers are reconditioned by removing old grease with cleaners' naphtha, after which the rifling is cleaned by running adjustable wire brushes through the bore. These brushes are designed to reach every part of the rifling, including the corners of the grooves, and are pushed through the bores longitudinally with a slight rotary movement to follow the rifling. In cases where this is insufficient, the acid treatment is used.

Motors of tanks, tractors and trucks have spark plugs removed and a half-pint of oil poured into each cylinder and the motors turned over by hand quarterly. Once each year the vehicle is operated under its own power, at which time it is thoroughly checked, all oil holes and grease cups are filled, and careful attention given to those parts which experience has shown are possible objects of deterioration.

Possibilities of the "Air Tank"

Part VI: Sky Raiders (Continued)

By Fred. H. Wagner*

REFERRING to the closing paragraph of Part V of this series, let me quote Germains: "The defender is not likely to confine himself to any one particular method of defense, he will use a combination of varying methods in varying degrees. He will have his observation posts flung scores and even hundreds of miles ahead to gain early news of a coming raid, and swift as is the airplane, the electric telegraph, whether by cable or wireless, is swifter. To surprise a community vigilantly equipped for defense will be well-nigh impossible. Time will be afforded to the defender to shroud himself in drifting banks of artificial fog, or to initiate anti-poison-gas measures. Nor will he wait for the aircraft to get near enough to his vitals to be truly dangerous. Twenty, thirty or even forty miles ahead, he will meet the attacking airmen with his floating aerial obstacles, his floating aerial mines (percussion), and his driving banks of smoke. Under a well considered scheme, every element of defense will work together to bring disaster upon the assailant. Let the airmen dive or ascend to avoid the obstacles, and they will come into a concentrated blast of gunfire. Let them seek to avoid gunfire, and they will run into smoke clouds, and these will be among the airmen's most formidable difficulties, for in the smoke they are blind, and the danger of being entangled with aerial obstacles and aerial mines will be so formidable that no airman will lightly brave it. Looking at the matter cold-bloodedly, it is difficult to conceive of any enterprise more hopeless of success than the effort to beat into submission any great industrial state by means of an attack from the air, *unsupported by any other means of attack*." The italics are mine.

This latter is probably the time when the separate air force, or department of the air, will look for help to the old army, which the airmen so arrogantly try to push into oblivion with their superman claims. Again,

"The airplane, like the ship, is a conspicuous target, and can be seen from far away. The airplane, like the ship, but in infinitely greater measure, is limited in her carrying power by the necessity of providing her own flotation and mobility. The airplane, you will say, has a vastly greater target in the great city than the ship has in the fort. Yes, but to reach this target she has to pass an outer girdle of defenses, invisible to herself, for they will be cunningly concealed, whereas she herself will be visible. She will have to face a *hitting power* infinitely beyond her power to return in kind. She will have to pass defenses planned with all the skill and ingenuity of a highly industrialized community fighting for its life. If the net result of the numerous and repeated attempts by the Germans to bomb London was merely, in the last resource, to convince them that the game was not worth the candle: how can we believe that any different result will be reached in the next war? No doubt in these attacks the means of offense were primitive as compared with those of today, but the defense was even more unorganized. The air attack which comes as a surprise will always be formidable, and there could be no greater mistake than to under-estimate the necessity of constant watchfulness, and the provision of adequate defense. But it is just as much a military vice to over-estimate a danger as to despise it."

IT is the commonly accepted theory in the civilian mind that air forces are the only possible defense against air raids. But, with the limited number of pilots who would be available at the outbreak of war, there would be but few who could be spared for the protection of interior areas. This is due to the necessity of mobilizing every combat plane available for striking the enemy's air force in the field; in other words, sound strategy will compel the high command to attempt attaining mastery of the air at once for the preservation of the field forces.

This then requires an effective organization of ground defenses for protecting interior areas, which is made possible by the remarkable improvements made in the past few years in antiaircraft guns and methods of control. With modern equipment the ground forces should certainly be capable of playing a most important role in the defense against sky raiders, since if it is possible to keep the hostile raider under observation for sufficient time to permit of laying the guns on the target, there will be no question but that the raider will be given a most interesting experience.

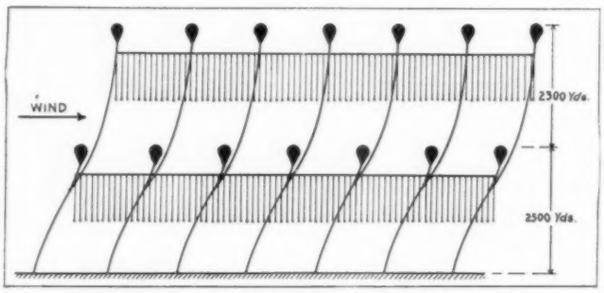


Fig. 1. General Arrangement of Aerial Barrier.

The arrangement of aerial obstacles or barriers, as mentioned above, is shown in Fig. 1. Such a method constitutes a passive defense against sky raiders at night by means of captive balloons, the result of which is quite effective. The balloons, when in a single formation, float at a height of 6,000 to 7,000 feet, and when in tandem the upper balloon reaches a height of from 12,000 to 14,000 feet. The balloons should be arranged in groups, with the individual balloons from 900 to 1,500 feet from each other; a horizontal cable, attached to the anchor cable of each balloon, is located about 900 feet below the balloons for the purpose of suspending wire streamers 1,000 feet long and about 75 feet apart, each wire being kept taut by means of a 2-pound weight attached to its lower end. This arrangement forms a very effective network or barrier, since any airplane trying to

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pass it will probably find its propeller winding in the suspended wires with a consequent wreck.

The moral effect of such a barrier must also be reckoned with, and no airman will attempt to pass through these wire streamers provided he knows of them.

The antiaircraft gun batteries should be located on the flanks of the balloon line, as shown in Fig. 2, consequently, should the enemy locate the balloons, he will find himself in a zone of bursting shells while attempting to pass around the balloon lines. Such barriers compel the airman to make detours from vital points thus covered, or they will compel him to fly above the balloons. The moral effect of such barriers is increased immeasurably when their location is frequently changed, thus making their position uncertain to the enemy airman.

Beside such defense as is offered by aerial obstacles and mines, the latter floating from balloons, smoke clouds and antigas, the principal defense will lie in counter air attacks and in gun fire.

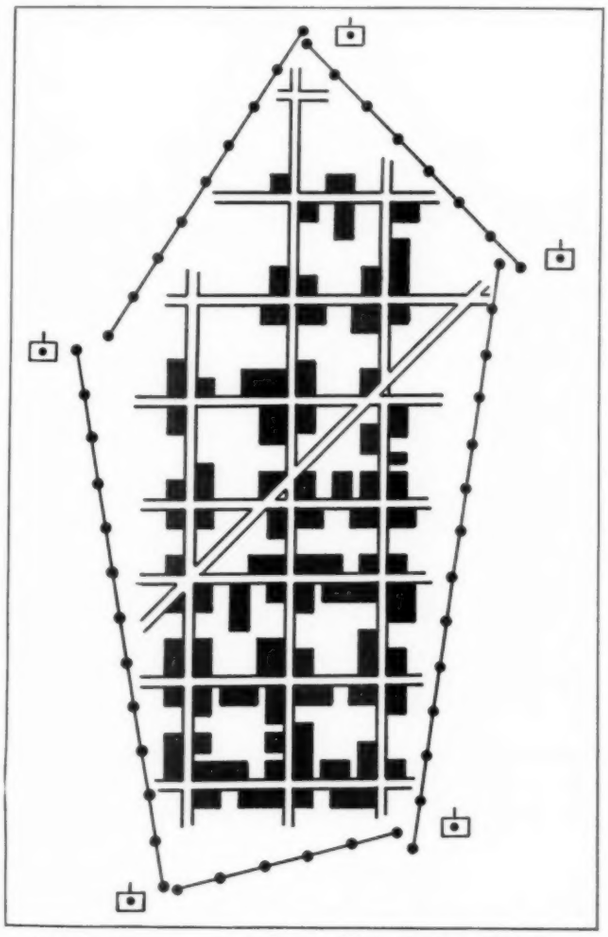

Fig. 2. Arrangement of Barrier With Flanking Batteries.

As stated before, the radius of action of a bomber from his base is a limited one, and since he must carry a considerable weight in bombs, besides his fuel, his ceiling is limited. This condition is amplified by the pilot's necessity for accurate navigation to reach his objective, and this can be done only by ground observation. A third reason is the necessity of flying low enough over the target, the object of his mission, to place his bombs where intended.

A definite target is necessary if the mission is to be a success. The indiscriminate dropping of bombs over a city is not very effective because, as shown in the recent war, only too often they drop in very sparsely populated areas or into open spaces. This requires that the bomber shall fix his bomb sights on the target selected, and this in turn requires that he keep on a certain course and at a fixed altitude for a time sufficient for him to drop the bombs at a spot where they will reach the objective. The bomber cannot dive down towards his target, for then his bomb sights would become ineffective. Besides such a dive will bring him closer to the fire from the antiaircraft guns, thus greatly placing his safety in question without any assurance of accomplishing his mission.

The airplane is a very fragile structure, and not very much is required to destroy it, hence should it come within 150 feet of the point of burst of a 3-inch high-explosive shell it will be in the destruction zone with but little chance to escape.

RECENT developments of antiaircraft guns and their appurtenances by our Ordnance Department are so much in advance of what the recent war produced that the intrepid airman, be he as brave as may be, will think more than twice before he ventures within their sphere of fire. In spite of the inefficiency of the antiaircraft guns of the war period, as compared with those of today, the former gave very effective service towards the end of the war. These guns were particularly effective in defending Paris against raids; it is estimated that 500 German bombing planes were sent against the city at various times, but a total of fifty, or only ten per cent, passed the antiaircraft defenses. Fifteen bombers were brought down, and from Germany we have the report that many others were unable to continue on their mission and were forced to turn back; also that 45,000 pounds of bombs were sent out against Paris, but of these only 3,500 pounds were dropped. The Germans were compelled to turn back and, since the bombers could not land safely while carrying the bombs, this large load was wasted in blowing holes in the ground of their own territory, or they were dropped in streams.

It is also a fact that the German antiaircraft batteries did remarkable work against Allied raiders, and from a German report we learn that seventeen Allied planes were brought down in one day in the region of the Somme. Towards the end of the war the skill of the American artilleryman also was rapidly increasing, and between July and November, 1918, the records show 17 planes brought down with 10,273 shots, or about 605 shots per plane. There is no record available to me as to the number of shots fired by the German antiaircraft artillery, but here also we find a remarkable progressive improvement in results. The planes shot down by the Germans numbered 51 in 1915, 320 in 1916, 467 in 1917 and 748 in 1918, a total of 1586 planes.

Today, with our 3-inch antiaircraft gun, equipped with its modern director and sound detector, a recent record shows targets to have received 202 hits for 3465 shots, or one hit for every 17 shots. It is of course impossible to estimate what actual damage would result from such hits, but, and to say the least, they would give the raider a rather uncomfortable time. In later practice the target was brought down from an altitude of 13,000 feet after the twelfth shot,

followed by a similar fate for another after the sixteenth shot from one gun.

HOWEVER, before you can shoot at an airplane it is necessary that you locate it and obtain its accurate range, and for this duty we have developed instruments which are almost unfailing in their accuracy. The problem set the Ordnance Department was a most difficult one, since it is not necessary only to see the airplane in the sky, but it is also necessary that the distance between the observer and the plane, as well as its height in the sky, be determined. Besides this, it is also necessary to know its speed and the direction in which it is flying. With this knowledge before us we must be able to compute the proper setting of the sights in order that the gun may be so pointed that at the expiration of the time limit allowed for the plane's flight for the range and elevation given, both the plane and the gun's projectile will meet at the designated spot. This requirement also predicates the setting of the fuze at a point which will cause the bursting of the projectile when it meets the plane. It is not necessary here to further dwell upon the difficulties presented by this complicated problem, requiring instantaneous and continuous computations, with the instant gun laying and fuze setting, to meet the answer to the computation. Suffice it to say that the "director," which is the soul and brains of the fire-control system for antiaircraft guns, is an accomplished fact.

This director is an instrument which automatically and continuously observes the plane in the sky, which computes its future position, which translates these computations into a movement of pointers for azimuth, elevation and fuze-setting dials.

Such directors are, of course, operated optically at the observation post, but on dark nights quite different problems confront us, and these necessitate additional apparatus. It might be considered almost impossible to locate enemy planes flying in the dark, but here "sound" comes to our assistance. After the "sound locator" has determined the position of the plane in the skies by azimuth and elevation this information is transmitted to the searchlights, which latter must then throw their beams on the raider, thus giving the combat planes an opportunity to engage the enemy, or the ground guns, through the "director" which can now observe the plane, can be trained on the raider's course. Should efficient "silencers" be perfected for airplane engines, the movement of the plane would still create vibrations in the air, and these vibrations can be measured and the location of the plane be transmitted to the searchlight.

We have now located the enemy plane, but we must still bring it to earth, and by means of the instruments mentioned the synchronous fire of a battery of guns may be controlled. The three weapons at our disposal for this purpose are the 105-mm., the 75-mm. and the 3-inch antiaircraft guns, the former on a fixed mount being one of the most powerful weapons in our service. This gun has a length of 60 calibers, and it has a muzzle velocity of 3,000 feet a second; the projectile weighs 33 pounds and can be fired to a height of 42,000 feet, or eight miles. The 75-mm. is an "all-purpose" Field Artillery gun with a length of 50 calibers and a muzzle velocity of 2,600 feet a second; its vertical range is 31,000 feet or not quite six miles. The 75 is provided with a mobile mount from which it can be quickly dismounted; when mounted on a bogie the gun can be trailed behind a prime mover at relatively high speeds. When on this mount the gun has a traverse of 90 degrees and an elevation of 45 degrees. A motor truck has also been designed for this gun, the latter being placed on the truck by means of a crane attached to the latter and which can be removed in five minutes to give the gun a 360-degree traverse, the elevation in this case being 80 degrees. If necessary the gun can be quickly dismounted from the bogie or truck and set up on the ground, in which position it again has a traverse of 360 degrees and 80 degrees elevation.

For general aircraft defense, however, the 3-inch gun is our principal weapon. It has a length of 50 calibers and fires a high-explosive shell weighing 15 pounds with a muzzle velocity of 2,800 feet a second. It has a vertical range of over 31,000 feet, and a rate of fire of 25 shots a minute. This gun is provided with a mobile mount from which it can be emplaced in about 20 minutes. Mounted on heavy-duty balloon tires, it can move at great speed on good roads as well as across heavy and hilly ground. It can be tipped 25 degrees from the vertical without overturning. When emplaced it has 360 degrees traverse and can be elevated to 80 degrees.

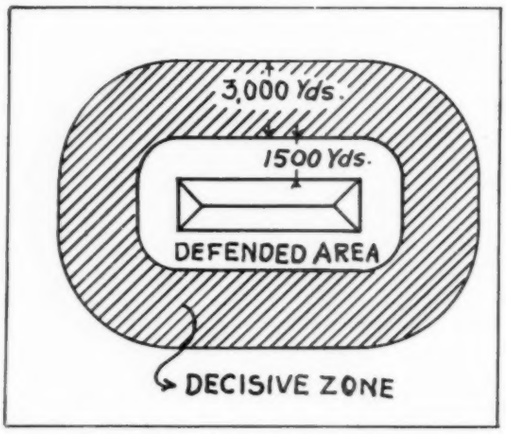

Fig. 3. Decisive and Danger Zones.

Aerial obstacles in conjunction with antiaircraft guns surrounding an area to be defended as shown in Fig. 2, or with gun batteries on the flanks of the barriers, will certainly make it rather difficult for the raider to wreak his will on the "nerve center." In order that the defense may be effective the raider should not be permitted to reach the zone to be protected, hence effective fire for a period of at least one minute is required; this is based on the bomber travelling at the rate of 100 miles an hour, in which case he will traverse approximately 3,000 yards in one minute. These 3,000 yards are termed the "decisive zone," as shown by the shaded portion of Fig. 3. Should the bomber, however, pass safely through this zone, and should he release his bomb at the inner edge of the zone, the bomb may strike within the defended area because the horizontal range of a plane with a ceiling of 5,000 feet, and traveling at the speed given above, is 1500 yards.

The longer the time the sky raider is under the fire of a given volume, the greater chance is there for his destruction. This fact calls for the concentration of a number of batteries, their number in turn depending upon the area to be de-

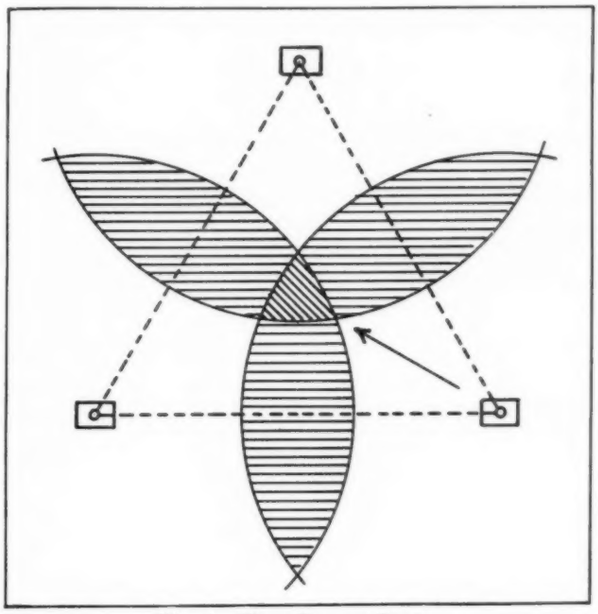

Fig. 4. Three-Battery Zones.

fended. For small areas three batteries are deemed sufficient, the batteries being placed in triangular formation, as shown in Fig. 4, with a length of from 3,000 to 5,000 yards for each leg of the triangle. The area to be defended is the center of the triangle, and the raider's only line of approach would be that shown by the arrow; any other line would bring him into the firing zone of two batteries, but directly over the defended area the zone is covered by three batteries.

Fig. 5 shows a four-battery plan, the area to be defended being the center of the star; here, whether approaching by A or B, the raider will be in the zone of two batteries, while the center is defended by four batteries. Fig. 6 contemplates the employment of nine batteries, the area to be

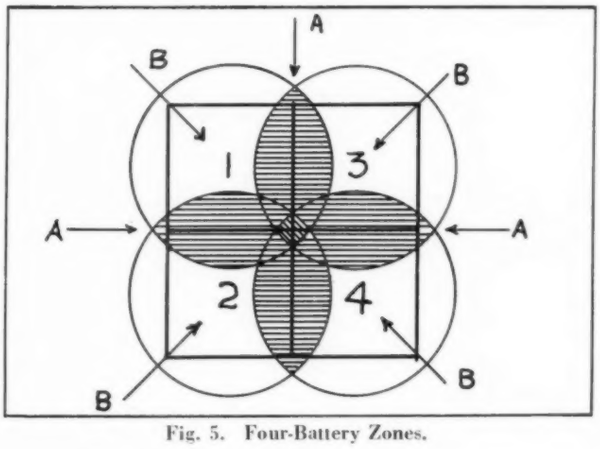

Fig. 5. Four-Battery Zones.

defended being zone 5; an approach by way of A will always lead into the fire of two batteries, while by way of B he will be opposed at first by two and then by four batteries.

The defense of a larger area is shown in Fig. 7; it will be noted that this contemplates the use of ten batteries, nine of them, including the two placed on the hill to the south, are in the "decisive zone," while the tenth is located approximately in or near the center of the defended area.

I have not attempted to show in this article what may happen to a large body of moving troops, but have confined my remarks to raids on "nerve centers." Sky raiders will be one of the most formidable enemy moving troops, troops detraining, or troops in bivouac will encounter. Detraining points and bivouacs may be protected by anti-aircraft batteries, but the advent of the sky raider will make necessary considerable changes in our tactical formations. As far as I know, very little has been accomplished in this direction, but it is a subject which should be given every consideration. It is possible that if troops are moved in small formations, with considerable intervals between units, the columns would be able to deploy in a very short time, thus greatly altering the airman's target, but this will lead to some disadvantages, such as changing front or direction. However, I am positive that tactics will be able to meet the situation after the matter has been given proper study. It will also be necessary to utilize all secondary roads, especially for the artillery and, if necessary, these should be moved across country. The problem is too large to be

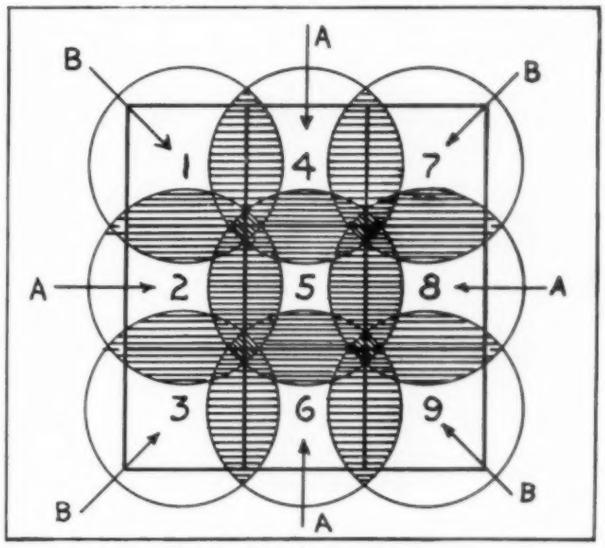

Fig. 6. Nine-Battery Zones.

entered into here, and its solution will require extensive study and coöperation between the various service arms.

WE are all agreed that proper preparedness is a necessity, but in closing this article I wish once more to state that the subject of a proper air force is both a moral and an economic one. When compared with other nations our air force is at a low ebb, since France possesses 132 combat squadrons, England 57 (not including Colonial ones) and Italy 67 land and 19 amphibian, a total of 86, while we tail along with 31 combat squadrons at present. These are all exclusive of naval planes. It is true that the nation best provided with air forces will be able to strike instantly and with great weight, thus giving it an opportunity to maintain aerial supremacy, and any country which may be caught unprepared in adequate aerial defense is bound to suffer severely when an attempt is made to improvise one after the declaration of war. When we entered the recent war we possessed some fifty obsolete planes. The conditions existing at that time have changed materially, and we are

able today to build more planes in a given time than any other people. During 1930 the United States produced airplanes at the rate of 120 per working day, of which 72 per cent were for civilian use, 20 per cent for military use, and

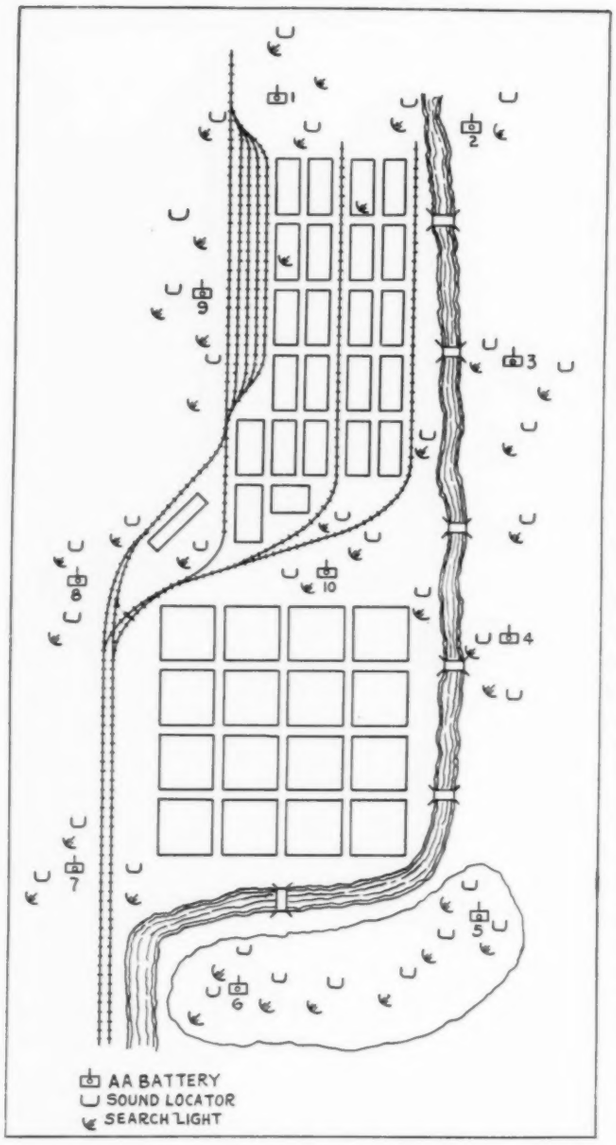

Fig. 7. Defense of Large Area.

8 per cent were exported. In 1931 the production was at the rate of 100 per working day, of which 68 per cent went into civilian service, 28 per cent into military service, and 4 per cent were exported. During this entire period the plane manufacturers were crying for work, since the existing plants were operating far below capacity. We did not enter the last war overnight, and that we should engage in another without due warning is not to be thought of, consequently the necessity for a great armada of 2,400 fighting planes seems rather a stupendous program at present. We know what we require in an emergency, and providing we have sufficient planes to take care of our present needs, the remainder can be obtained in time—also providing we have the trained personnel on hand to operate them. But six weeks' training every year will hardly accomplish this.

On the other hand, additional appropriations for anti-aircraft batteries with their appurtenances will not be amiss, because here we have a weapon which will still be worth considerably more than ten cents on the dollar a decade from now, and far more time is required for the manufacture of these batteries, directors, detectors, etc., than is required for airplanes, the production of which is now a daily occurrence.

It has also been suggested that the people be made acquainted with gas and bomb defense. When terror is inspired, panic will doubtless follow, and there is no doubt but that exploding bombs dropping within the confines of a city will occasion terror, and the only safety here is descent into a cellar, the deeper the better. But everyone will possibly not have a cellar handy when the bombs drop. It is recorded on one night 300,000, mostly foreigners, of London's population found refuge in the rail-subways alone, but the native population, after some little experience, did not stampede so hurriedly. However, our propagandists now insist that in the future London's experience will be but child's play compared with what is in store for the civilian. Proper instruction will ease the public mind to a great extent and will be a safety-first campaign which, unfortunately, may call for an appropriation of additional money. The proper use of gas masks and where they may be obtained, will also have a quieting effect on the people, hence let them be informed through some proper channel. Let us look for a moment into a proposed German scheme for discovering and announcing a coming attack from the air. Here we find the various borders divided into districts, each of the latter being provided with a scouting flight, all of the latter being in communication with an air-warning central. The latter pins the announced positions of the advancing enemy planes on a cross-section map, hence is informed at every moment of their location. The "central" then communicates with all points which may lie within the danger zone, where both electrical and optical signals are employed for conveying the warning to the population, but care is taken that these warnings are not of a character to induce panic among the people. Also, the "central" is in communication with whatever defense has been established, including of course both ground and air forces, the latter immediately taking off to meet the coming enemy. The civilian population is to be thoroughly instructed as regards its course in the emergency, and to give what assistance may be possible.

Armaments in themselves, contrary to the opinion of our pacifists, are not a cause of war, rather a safeguard against it, but the causes of war are usually found in oppression, injustice, avarice, jealousy, hatred, fear and suspicion. These vices cannot be expelled from the world, hence armaments must be provided for protection. Nor are armaments the reason for economic distress, since they have always been with us, in times of prosperity as well as in those of economic depression, without being a controlling factor in either period. Since then armaments are necessary as a preparatory measure of protection, let us build up to what is considered as giving the best return for the expenditure, compatible with protection, and not dissipate our limited appropriations in material which may be of doubtful value should the misfortunes of war ever overtake us.

(Part VII will be published in the May-June issue.)

Principles of Firearms Identification

Fingerprinting Ordnance in the War on Crime

By Charles O. Gunther*

THE science of identification of firearms concerns itself primarily with the development of methods by whose application it may be possible to solve four types of problems:

I. Given a discharged cartridge case to determine the type and make of firearm in which it was discharged.

II. Given a bullet to determine the type and make of firearm from which it was fired.

III. Given a discharged cartridge case and a suspected firearm to determine whether or not the cartridge case was discharged in the suspected firearm.

IV. Given a bullet and a suspected firearm to determine whether or not the bullet was fired from the suspected firearm.

It is the purpose of this article to discuss briefly these types of problems and the methods involved in attempting their solution. Definition must first be made of the terms "class characteristics" and "accidental characteristics."

A Fatal Bullet (5.6x) in State of New Jersey vs. Rusnak. This evidence was properly presented at the trial and told its own story. The defendant was found guilty and was electrocuted.

Class characteristics are those which are determinable *prior* to manufacture. Before a particular type of firearm goes into mass production there will have been prepared the drawings, specifications, schedules of manufacturing operations, and, since interchangeability of parts is essential, provision will have been made for the necessary gages, jigs and fixtures. All information relating to the firearm which can be obtained or formulated from an examination and study of these drawings, specifications, and provisions, will be grouped under the head of class characteristics. Such information may relate to the dimensions of component parts; peculiar features of design, operation, or construction; or the machining and other operations by which certain parts are produced. Class characteristics are controlled by man.

Accidental characteristics are those which are determinable only *after* manufacture. They are characteristics whose existence is beyond the control of man and which have a random distribution. Their existence in a firearm is brought about through wear, the failure of a tool in its normal operation, abuse, mutilation, corrosion, erosion, and other fortuitous causes. Dimensional variations in class characteristics, whether within or outside of the tolerances allowed by the specifications, are accidental characteristics. These become apparent only when instruments of precision are employed. Accidental characteristics exist in all firearms and are independent of class characteristics.

IDENTIFICATION and classification are so closely associated that we can not think of one without, consciously or unconsciously, involving the other. There are several ways in which characteristics may be classified, each serving a special purpose, each having its particular mode of grouping, but all with the same purpose in view—identification.

A classification is necessarily based on a similarity of some sort, and it is therefore possible to group firearms according to class characteristics. After class characteristics are exhausted for the purpose of grouping, the further classification of a group of firearms with common class characteristics can be accomplished only by a grouping according to accidental characteristics.

Ammunition may be used for the purpose of assisting in the identification of the manufacturer of the firearm by establishing the identity of the manufacturer of a particular cartridge case or bullet. For this purpose ammunition may be classified in the same manner as firearms by grouping cartridge cases and bullets according to class characteristics. Further classification by grouping according to accidental characteristics is manifestly unnecessary.

If a firearm possesses a combination of class and accidental characteristics not found in any other firearm, then such a combination becomes an "individual peculiarity" of the firearm by which it is differentiated from all other firearms in existence.

Accidental characteristics are of vital importance in determining the identity of a particular firearm. Obviously not all firearms in existence can be examined for accidental characteristics and therefore the science of identification becomes fundamentally a mathematical science in that it must determine from an examination of relatively small

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groups of firearms the probable distribution of accidental characteristics in the larger groups. The science of identification consequently has recourse to the laws of permutations and combinations, the theory of probability, and other mathematical rules—the same mathematical fundamentals which in one form or another, find their application in practically every field of human endeavor. Faith in the use of finger prints as a means of identification has been

Battered but Convicting Evidence in State of New Jersey vs. Mangino.

This bullet was recovered from the head of a murdered woman. It was identified as having been fired from a gun found near the scene of the crime. The defendant is now serving a life sentence.

built up even though there have been examined and classified the finger prints of but relatively few persons when compared with the total population of the earth.

Problems analogous to those in the identification of firearms are found in tracing the origin of typewritten material. It would be a simple matter to group typewriters according to class characteristics and thus differentiate between the different makes. To determine the make of the typewriter on which a certain document was typed is not so simple because the make must be determined by class characteristics (size and style of type, spacing between letters and lines), which can be recognized from the typewritten material constituting the document. The problem can be solved only when the class characteristics recognizable from the typewritten material are sufficient to identify the make.

CONSIDERING now the types of problem in connection with the identification of firearms, we find that every firearm adapted to fixed ammunition engraves its "signature" on the ammunition fired in it, one part of the "signature" appearing on the cartridge case and the other part on the bullet. In discussing these problems the expression "type and make of firearm" refers to all arms of a certain type and make without reference to length of barrel, finish, stocks, grips, or other non-essentials. The expression "type of ammunition" applies to ammunition of three types: pin fire, rim fire, or center fire.

In the first type of problem the cartridge case gives evidence of the caliber and type of ammunition. The class characteristics of the type and make of firearm in which the cartridge case was fired must be determined from the marks, impressions and deformations on the cartridge case which constitute one part of the firearm's "signature." Pertinent class characteristics may be found in the following:

Breech block or recoil plate: Design features and machining operations.

Firing pin: Size and shape of impression on base of cartridge case in rim-fire ammunition.

Type, diameter, shape of nose, angle of percussion, machining operations, in center-fire ammunition.

Shape and size of nose of hammer in rim-fire ammunition.

Extractor.

Ejector.

Magazine.

Condition of all surfaces with which the cartridge case may come in contact in the firearm.

Cartridge cases from automatic weapons show more marks and deformations than do those from revolvers, and therefore offer greater possibilities for determining the class characteristics of the weapon in which they were discharged. The problem is completely solved only when the class characteristics as determined from the marks, impressions and deformations on the cartridge case point to a group embracing but one type and make of firearm.

In the second type of problem the caliber of the firearm can be readily determined from the bullet and in some cases it is possible to determine whether or not the bullet was fired from a revolver. The class characteristics of the type and make of firearm must be determined from a study of the engraving on the cylindrical portion of the bullet which constitutes that part of the firearm's "signature" which appears on the bullet. The class characteristics that may be so determined are: bore diameter, depth of grooves, number of grooves, direction of twist of rifling, pitch of rifling, land widths, and groove widths. The problem is completely solved only when the class characteristics of the firearm as determined from the part of the "signature" on the bullet lead to a group embracing but one type and make of firearm.

To solve the third type of problem it is necessary first, to establish by the class characteristics as indicated in the solution of the first type of problem the fact that the cartridge case could have been discharged in the suspected firearm; second, to determine from that part of the "signature" which appears on the cartridge case the accidental characteristics of the firearm in which the cartridge case was actually discharged; third, to verify the existence of these accidental characteristics in the suspected firearm; fourth, to establish the improbability of the coexistence in another firearm of the combination of class and accidental characteristics which have been determined.

To solve the fourth type of problem it is necessary first, to establish by the class characteristics as indicated in the solution of the second type of problem the fact that the bullet could have been fired from the suspected firearm; second, to determine from that part of the "signature" which appears on the bullet the accidental characteristics of the firearm from which the bullet was actually fired; third, to verify the existence of these accidental characteristics in the suspected firearm; fourth, to establish the improbability of the coexistence in another firearm of the combination of the determined class and accidental characteristics.

Demolition Bombs

The Use of Modern Welding Processes of Manufacture

By H. S. Beckman*

FROM the time when aviation became a practical possibility, it was recognized that one of the chief functions of the military airplane would be to drop bombs. It appears that optimism as to the possibilities of bombing reigned supreme at that time, and little attention was, therefore, paid to difficulties which might arise as development progressed. Writers referred to the aerial bombs as the artillery fire of the air which would reach any target in enemy territory within flying distance of the airplane which carries it, a distance greater by several hundred miles than the longest range of a gun. Long before the World War, bomb-dropping exhibitions were given at aviation meetings. Due to the fact, however, that the airplanes carrying the bombs were constructed of frail, open framework, with small engines and very limited lifting power, the bombs dropped were, of necessity, very small. Some "bombing" in these early contests consisted in dropping oranges and bags of flour upon targets outlined on the ground.

The first use of bombs in warfare was made by the Italians in their campaign in Tripoli in 1912. The bombs which were then used were converted from some other type of ammunition and were effective only against personnel. With each increase in the lifting capacity of the airplane came an increase in the number of such bombs carried until a capacity was reached which permitted the use of larger bombs containing a greater amount of explosive. Development has now progressed to such an extent that at present the military bombardment airplane fully manned, equipped with machine guns, loaded with fuel, etc., can carry 2400 pounds of bombs. With this load, it can attain a height of over 20,000 feet, and a speed of approximately 190 miles an hour.

The most important type of explosive bomb is the demolition bomb, which, as its name indicates, is designed for the destruction of targets. The destructive effect produced by these bombs is the result of the detonation of the high-explosive contents. This detonation produces a vast amount of blast, the destructive effects of which increase with the amount of explosive in the bomb body. When the detonation takes place above ground, as a result of instantaneous fuze action, metal fragments from the body casing are scattered at high velocities for great distances. Experiments conducted indicate that fragments from the metal case carry destructive effects to much greater distances than blast. However, within a limiting radius, blast is far more effective than fragments. The mining effect resulting from the detonation of the explosive below the surface of the earth, obtained through the use of delayed-action fuzes, is of great importance in demolition bombs to destroy the target directly or undermine its foundation. The delayed action of the fuze also permits of the penetration of the bomb into the target, in the event a direct hit is obtained. All demolition bombs in service at present or under development contain approximately 55 per cent of explosive by weight.

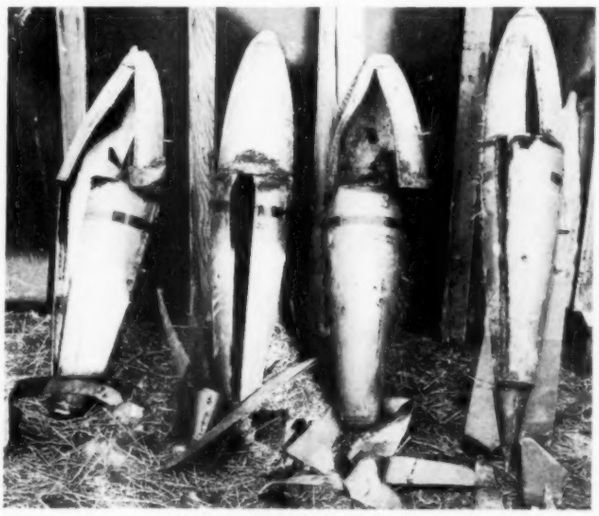

Fig. 1. Bomb Body Failures.

100-lb. bombs welded longitudinally and circumferentially failing on impact with hard surface. Altitude of release, 2000-ft.

Fig. 2. Meeting the Rigid Test.

300-lb. bomb welded only circumferentially withstanding impact on the hard surface. Altitude of release, 4000-ft. In this design of body the longitudinal weld is eliminated.

THE first demolition bombs which were manufactured during the World War in this country were of the streamline type. These existed in sizes of 25-lb., 50-lb., 100-lb., 300-lb., 600-lb., and 1100-lb. The various pressed steel sections and the nose steel casting, when used, were welded

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together both longitudinally and circumferentially. Acetylene welds were required. Tests were also conducted at the Aberdeen Proving Ground with bombs which were electrically welded. In view of the state of the art of welding at that time, all sections were welded together manually. Presumably there were no strength requirements of the bomb cases at that time, for there is no record of development tests having been conducted with that in view, nor do the specifications make mention of any such tests as are now prescribed for demolition bomb cases.

Fig. 3. Released from 2000-ft. Altitude.

100-lb. bomb welded longitudinally and circumferentially by the automatic metallic arc process, recovered after impact on hard surface. Slight bulge in front of nose weld.

In 1919 a Bomb Board was convened to consider and make recommendations on the policy for future bomb development. In dealing with the strength of bomb cases, the Board recommended that thin case type of bombs be developed to have as high a ratio of explosive to total weight of bomb as could be obtained and yet allow the bombs to penetrate the average unprotected structure without breaking up. In defining the term "average unprotected structure," the Board stated that for the present that structure be considered to be simulated by a hard surface to be used as a target in tests. It was specified that the hard surface consist of a block of concrete one foot thick superimposed over crushed stone two feet deep. In compliance with the recommendations of the Board, there was constructed at Aberdeen Proving Ground such a hard surface which is 200-feet square.

The present strength requirement, which is the same for all demolition bombs except the 100-lb., specifies that the bomb case, inert loaded to weight, must penetrate the hard surface without breaking up or being unduly deformed when dropped from an altitude sufficient to permit penetration of the maximum diameter of the bomb below the one foot of concrete. This altitude varies between approximately 1500 feet and 4000 feet, depending on the shape and weight of bomb, the lower height corresponding to that required for a 2000-lb. bomb, while the greater height is necessary for the 100-lb. bomb. In view of the fact that 100-lb. demolition bombs will be used against only light structures or targets where considerable strength is not required, experimental bombs of this size need withstand the impact only on crushed stone when dropped from an altitude of 15,000-feet.

When the welded streamline bombs, manufactured during the World War, were subjected to the tests on the hard surface, they failed to meet the strength requirements. Bombs, either gas- or electrically-welded, broke-up on

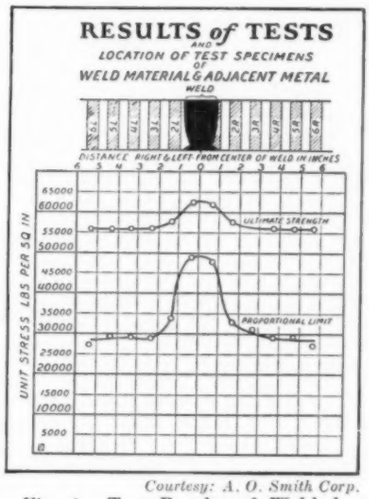
Fig. 4. Released from 5000-ft. Altitude.

100-lb. bomb welded longitudinally and circumferentially by the automatic metallic arc process, recovered after impact on hard surface. Case bulged, but welds remained intact.

Fig. 5. Released from 4000-ft. Altitude.

100-lb. bomb welded longitudinally and circumferentially by the automatic metallic arc process, recovered after impact on hard surface. Nose and body sections slightly bulged near weld.

impact (Fig. 1) primarily at the welded joints. An examination of the ruptures revealed that the bombs were merely "skin welded," i. e., the weld did not penetrate through the joints in any case. This may have been due partly to the fact that the requirements necessary for a good weld were not known or specified, and partly because of the human element and the lack of proper welding equipment. New designs were prepared in 1921 which eliminated the longitudinal weld and required the welding together circumferentially of deep drawn steel sections and nose steel castings, where used. Bombs thus manufactured experimentally (Fig. 2) met the strength requirements. It was not known to what extent the care taken in welding bombs on an experimental order was responsible for the satisfactory performance. It was felt that the personal element which, no doubt, was to a great extent responsible in 1917 and 1918 for "skin welds" may, considering the state of the art of welding in 1921, also produce such welds in production, inasmuch as welding had not at that time progressed to the automatic stage.

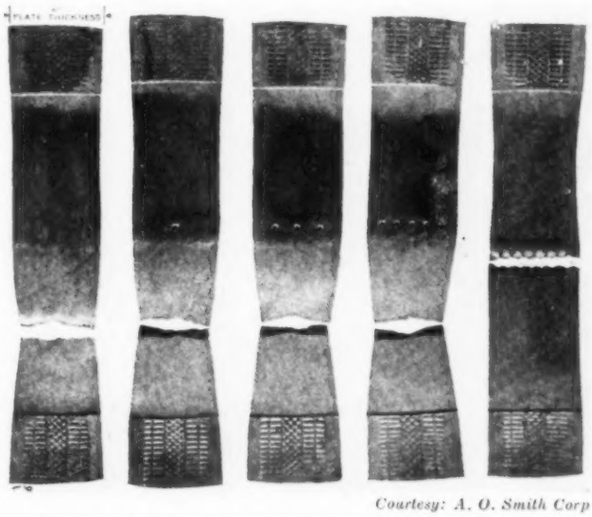


Courtesy: A. O. Smith Corp.

Fig. 6. Test Results of Welded Material and Adjacent Metal.

Specimens from welded plates 2⅝ inches thick showing the weld and adjacent metal stronger than the original plate. Specimens were cut at 1-inch intervals parallel to the weld and pulled in the same direction.

IN an attempt to eliminate this objection and to reduce the cost of manufacture of demolition bombs, a new line of development was started, that of manufacturing cylindrical instead of streamline bombs. It was the object of this development at that time to utilize the seamless tube and pipe industry and concerns engaged in manufacturing oxygen cylinders and similar products for fabricating the bombs. Although the first design of a cylindrical demolition bomb, which was that for the 2000-lb. bomb, had nose and tail steel castings both riveted and welded to a seamless tube, later designs of this and other bombs eliminated both riveting and welding. As finally developed, this series of bombs—100-lb., 300-lb., 600-lb., 1100-lb., and 2000-lb.—consisted of bomb bodies made in one piece, closed at the rear end by a cap screwed to the bomb body. The dimensions of the cylindrical portion are so chosen that, in production, no machining will have to be done on that part of the bomb body. The only portions of the bomb bodies as drawn which require machining are the nose and rear.



Courtesy: A. O. Smith Corp

Fig. 7. Tensile Test Specimens Cut Across a Weld Joining Plates 6 inches Thick.

Specimens were machined all over to give a uniform section. The area through the weld was reduced in varying amounts by drilling holes. Not until the area was reduced 24.3% by drilling 7 holes did the specimen break through weld.

The advantage of the cylindrical demolition bombs manufactured by the above process is that they should be cheaper to manufacture, inasmuch as the number of drawing operations will be less than those required in the manufacture of the streamline type in which the various drawn sections are welded together circumferentially. In addition, the operations of loading the cylindrical bombs with high explosive are facilitated, inasmuch as the hole in the rear of the body through which the bomb is loaded is considerably greater than that in streamline bombs. The realization of these advantages is not obtained at the expense of either satisfactory flight or other important ballistic properties. Tests at the Bureau of Standards and at the Aberdeen Proving Ground indicate that excellent flight characteristics are obtained with cylindrical bombs.

All bombs manufactured by either the pierced billet or cupped plate method have successfully withstood the hard surface impact without the least deformation. The Bethlehem Steel Company and the National Tube Company have thus far manufactured all bombs of this type for the Army for its experimental and development work.

ANOTHER method of manufacturing the one-piece bomb bodies is to swage a seamless tube to the contour adopted in the design of demolition bombs. Although the nose end of the 100-lb. bomb does not thicken in the swaging process exactly to the dimensions appearing on the drawing, the thickness is sufficient to permit the bomb to withstand the forces incident to hard surface impact. This bomb is designed for less severe impact than that to which the bomb was subjected in these tests, inasmuch as present tactics contemplate its use only on light structures and targets against which the bomb, equipped with fuzes functioning instantaneously, will be employed.

It may be stated that every effort is being made to increase the percentage of explosive in demolition bombs, consistent with strength requirements. In view of the progress which has been made in recent years in the field of aluminum alloys, it is only natural that investigation as to the satisfactoriness of this metal should be made. Aluminum alloy castings

were considered too brittle and of insufficient strength to warrant investigation. To determine, however, if bombs made by piercing and drawing forged aluminum alloy billets will be satisfactory, a small quantity was manufactured by the National Tube Company, in coöperation with the Aluminum Company of America. Tools, which were available at the National Tube Company and which were previously used in the manufacture of experimental 250-lb. steel bombs by the pierced billet process, were utilized in the manufacture of the aluminum alloy bombs.

Although it was not anticipated that these bombs would fully withstand the forces incident to impact on the hard surface if the bombs were dropped from the prescribed altitude, which would permit penetration of the maximum diameter below the 1-foot of concrete, it was felt that if the bombs were released from an altitude of approximately 2,000 to 2,500 feet they should not be unduly deformed by the impact. If that were the case, it would be possible to increase the wall thickness of the bombs to counterbalance the reduced tensile strength of the aluminum alloy as compared with steel. Even with this increased thickness, a considerable saving in weight would result. When dropped on the hard surface from 2,000-feet, 1,500-feet, and 1,000-feet, the bombs, however, broke up into a considerable number of fragments. This indicated that aluminum alloy bombs do not possess the shock-resisting properties which are characteristic of steel bombs, even though the other physical properties are satisfactory from the design point of view.

IN the discussion of the manufacture of war-time bombs, it was stated that one of the reasons for the weakness of the welds, and perhaps the most important, was the combination of hand welding and inferior welding equipment used at that time. That was approximately 15 years ago, and "much water has run over the dam" since that time. The human being who may yield to fatigue and, for that reason, can not produce a uniformly satisfactory weld has now been replaced by automatic machines. When one considers that the gas and oil industries utilize welded pipe in the transfer of their products to all parts of the country, and that welded high pressure stills are used in refineries and subjected to considerable pressure, one must realize that the welding industry has progressed to a point where full confidence is placed in its work. This necessarily follows from the fact that any leaks which may develop would greatly endanger life and seriously interfere with the operations of public utilities. In view of the progress in the art of welding and the fact that, in an emergency, certain industries which would be called upon to manufacture bombs would not be in a position to make bombs by piercing a billet or cupping a plate, the present possibilities of manufacturing bombs by modern welding processes have been investigated.

The first bombs manufactured by modern welding processes were of the 100-lb. size. Small quantities were fabricated, utilizing: (a) The atomic hydrogen process of welding, in which nose and tail steel forgings were welded circumferentially to a seamless steel tube; (b) the automatic metallic arc process of welding, in which nose and tail forgings were welded circumferentially to a longitudinally welded steel pipe, and (c) the automatic carbon electrode arc process of welding, in which nose and tail forgings were welded circumferentially to a longitudinally welded pipe.

Three bombs manufactured by process (a) were released from 4,000 feet on the hard surface. Two of the bombs thus tested withstood successfully the forces incident to the impact. Investigations as to the cause of the failure of the third bomb on impact indicated that some metal adjacent to the weld was burned, thus creating a weak section.

The bombs which utilized process (b) in their manufacture were welded by the A. O. Smith Corporation of Milwaukee, Wisconsin. One bomb released from 2,000-feet and another from 4,000-feet withstood the impact satisfactorily, being only very slightly bulged at the springing. Two other bombs dropped from 4,000-feet and one from 5,000-feet were considerably bulged on impact. In no case, however, did any of the longitudinal or circumferential welds show any signs of failure. Neither did the examination of the bomb bodies after impact reveal any cracks. Figs. 3, 4 and 5 show some of the bombs after being recovered.

The bombs which utilized process (c) in their manufacture broke-up on impact with the hard surface when dropped from 4,000-feet, the failure in all cases originating in the welds. The concern which accomplished the welding on these bombs claimed that the poor welding was the result of the excessive silicon content in the nose and tail forgings supplied to them.

The results of the hard surface tests with the automatic metallic arc welded bombs are in conformity with the contentions made by users of this process. Results of laboratory tests were carefully studied. It was shown that not only the weld, but also the metal adjacent to the weld is either as strong or stronger than the original plate. Fig. 6 illustrates graphically some of the physical properties of the weld material and adjacent metal as compared with those of the original plate. Fig. 7 records the experiments conducted by the A. O. Smith Corporation to determine how much stronger than the plate a weld can be made while still maintaining as nearly as possible the same chemical characteristics and an appropriate ductility. The procedure was to subject to pull tests a series of specimens, the welds in which had been weakened purposely. The first specimen, shown at the left, contained no drilled holes. The next had a hole drilled through the center of the weld .2-inch in diameter. The next one had three such holes, then one with 5 holes, and the last with 7 holes. Not until the area was reduced by drilling 7 holes did the specimen break through the weld.

Because of the properties of the modern weld, it has been found that, after a good weld is once made, it can be disregarded as a weld in any further operations. Drilling, tapping, machining, or additional welding is performed upon welded material the same as if it were the parent metal and no different treatment is accorded it. It is also claimed that material welded by modern processes responds structurally and in physical characteristics to heat treatment in a similar manner as does the steel in plate.

All the methods which are being investigated are with a view to increasing production of bombs in the event of a national emergency. It is certain that the concerns which are at present capable of piercing and drawing bomb bodies from a billet, drawing from a plate, swaging seamless tubing, and welding circumferentially nose and tail forgings to a longitudinally welded cylinder, will more than be sufficient to meet requirements for demolition bombs in emergency.

The Ballistic Efficiency of Guns

Has a Great Increase of Velocity and Range Been Attained?

By Lieut. Gen. H. Rohne, German Army, Retired*

AFTER the war many propositions were made with a view to increasing the ballistic efficiency of guns. The majority of these propositions were more or less worthless, because they could not be attained due to the fact that the requirements were too high or that, in spite of the high efficiency attained with regard to trajectory and range, the expected advantage was not obtained.

That is especially true of the invention of Gerlich, the engineer, about which both the professional publications (ARMY ORDNANCE, Vol. X, No. 60, and Vol. XII, No. 68) and the daily papers have given facts which need to be thoroughly investigated. In an article published by the inventor in *Wehr und Waffen* (April, 1931) he claims that from a 7-mm. gun projectiles weighing 6.5 and 9.0 g. are fired with initial velocities of about 1500 and 1400 meters per second and that at a range of 50 meters armor plate of the best steel, 12-mm. thick, has been pierced.

Now we must find out the following: (a) Under what conditions can such high velocities be attained; (b) What importance do they have for practical firing.

Concerning the first question, as a matter of fact even in the war initial velocities of 1500, or even 1600, meters per second were attained—not with rifles, to be sure, but with the well-known Krupp guns which were used for the bombardment of Paris and with which ranges of almost 130 kilometers were observed.

A certain definite initial velocity (v—meters/sec.) requires a certain average gas pressure P (kg./sq. cm.), which, aside from the frictional resistances, must have been exerted during the whole movement of the projectile through the bore, in order to attain the work stored-up in the projectile at the muzzle. This average pressure is the very minimum force which can produce the desired initial velocity. Let w be the weight of the projectile (in g.), L the length of the distance the projectile has travelled in the bore (in meters), a the caliber (in cm.), g the acceleration due to gravity (9.81 m/sec^2), then the average pressure must be

$$P = \frac{v^2}{2g} \times \frac{w}{La^2.\pi/4 \times 1000}$$

If we let $w = n \times a^3$, in which n is the (relative) average density (*Querdichte*[1]) and also if we let $L = al$, in which l is the distance covered by the projectile in the bore, then we get

$$P = \frac{v^2}{2g} \times \frac{n}{l \times \pi/4 \times 1000} = \frac{v^2 n}{15.4l \times 1000}$$

that is to say, the average gas pressure for a certain initial velocity depends upon the ratio between the relative density and the distance covered by the projectile in the bore expressed in calibers, but is not dependent upon the caliber, and therefore it is permissible to transfer this ratio of the cannon to a rifle.

For the long-range gun the amount of the average pressure is to be determined, at least approximately. According to the *Artilleristische Monatshefte* (November and December, 1922) with a caliber of 21 cm., the projectile weighed 100 kg.; this made $n = 100\,000/21^3 = 10.8$. The length of the whole tube is given as 36 m. = 171 calibers. From this we can deduce the following: 1, the distance from the junction cone to the end of the tube, estimated at 4 calibers (in the 50-caliber Krupp naval guns it was about 2.6 calibers in length), and 2, the length of the original combustion chamber, which may be approximately determined from the absolute weight and from the weight per cubic unit of the powder. The weight of the charge is given as from 180 to 300 kgs.; the average of 240 kg. is taken, the weight per cubic unit as 1.6 and the diameter of the chamber somewhat larger than that of the bore (23 cm.); thus we get a length of 360 cm. = 17 calibers. According to this, the length of the distance covered by the projectile in the bore is to be estimated as $171 - (4 + 17) = 150$ calibers.[2] We cannot count on absolute accuracy here. Hence the average pressure is calculated as

$$P = \frac{1500^2 \times 10.8}{15.4 \times 1.50 \times 1000} = 1050 \text{ kg/cm}^2$$

The maximum pressure is given as 3000 atmospheres = 3100 kg./cm^2, and from this the "pressure ratio" $n = 0.34$ is calculated.

In a 7-mm. rifle the same average pressure and the required initial velocity of 1500 meters per second would be retained if the projectile weighed $10.8 \times 0.7^3 = 3.7$ g., and the path of the projectile in the bore were $150 \times 0.7 = 105$ cm. The charge would have to weigh $240{,}000 \times 0.7^3/21^3 = 9$ g. Hence there can be no doubt that also in rifles an initial velocity of 1500 meters per second can be attained; so far, we have been satisfied with 900 at the most. But it is also certain that a projectile weighing only 3.7 g. and a rifle which is at least 45 cm. longer than the 98 rifle—hence heavier—cannot be considered as suitable for use in warfare.

THE inventor claims to fire a projectile that is at least 6.5 g. in weight and assures us that the length of the barrel and the weight of the rifle need not be increased above those of ordinary rifles. That is a basic error, as we shall demonstrate.

A projectile weighing 6.5 g. and having a caliber of 7

*By permission of the author and of the editor of *Zeitschrift fur das Gesamte Schiess und Sprengstoffwesen* (Munich), this article is republished from the December, 1931, issue of that journal.

1. This (relative) average density (*Querdichte*) is not to be confused with the cross-sectional density load (*Querschnittsbelastung*), that is to say, the ratio of the weight of the projectile (in g.) to its cross-section (in square cm.). In the article quoted here the expression *Querdichte* (average density) is used instead of "*Querschnittsbelastung*" (cross-sectional density).

2. This length is also given in the book entitled "The Paris Gun" by Lieut. Col. H. W. Miller, Ord. Res., U. S. Army.

mm. has an average density, $n = 6.5/0.7^3 = 19$. In the 98 rifle the distance traveled by the projectile in the barrel is 690 mm. In spite of the much more powerful, and hence more bulky, charge, let the length of the distance covered by the projectile in the bore in the case of a 7-mm. rifle be estimated at 700 mm., hence 100 calibers; then the *average* gas pressure is at least

$$\frac{1500^2 \times 19}{15.4 \times 1.00 \times 1000} = 2770 \text{ kg/cm}^2$$

hence it is almost as high as the maximum measured pressure in modern military rifles. It is without doubt considerably greater than the average pressure, but how much greater depends upon the rate of combustion of the powder. It is quite possible that by another chemical composition, by greatly compressing the powder mass, so as to get it in the proper form, the combustion will be made slower at first and gradually increase in velocity. Gradually tapering off the cross section of the bore toward the muzzle, like that produced in cannon by helicoidal rifling, might also help in making the change in the gas pressure less sudden. This can without doubt make the pressure ratio greater than 0.34. If we assume it to be 0.50, which is very favorable, we get a maximum pressure of 6540 kg/cm^2.

For the projectile weighing 9 g.—with a transverse density of 26.0—the ratios are still less favorable, although an initial velocity of only 1400 meters per second is attained; the average pressure in this case is 3340; the maximum pressure would therefore be about 6680 kg. per square cm.

I do not doubt that in the tests at the small arms proving ground at Halensee the velocities claimed were actually obtained. But certainly only a very few rounds were fired, which did not place nearly as great a strain on the firearm as would be placed on it under actual service conditions. It is noteworthy that in none of the reports published on the tests and the efficiencies attained are there any data concerning the gas pressure.

On the contrary it is claimed that, in spite of the greatly increased efficiency, the recoil of these rifles is not more perceptible to the rifleman than that felt when firing the "S" bullet from the 98 rifle. This is contrary to all laws of mechanics.

If v_0 is the initial velocity of the projectile, v_w the velocity of the recoil, w the weight of the projectile, c the weight of the charge, W the weight of the rifle (all these weights being expressed in kg.), then we get: [3]

$$v_w = \frac{v_0 (w + 0.5\ c)}{W}$$

Up to the weight of the charge (c) for projectiles weighing 6.5 and 9.0 g., all the values are known; for this an estimate must be made. The work stored up in the two projectiles is:

$$\frac{1500^2 \times 0.0065}{2 \times 9.81} = 745 \text{ mkg. } \textit{or } \frac{1400^2 \times 0.009}{2 \times 9.81} = 900 \text{ mkg.}$$

In no modern rifle is the work done by 1 g. of powder more than 130 mkg. Let us take a powder with great energy, which produces 150 mkg. of work per g. of weight, then the weight of the charge for a projectile weighing 6.5 g. would be 5 g., for a projectile weighing 9.0 g. it would be 6 g.

The velocity of recoil v_w is then calculated—for all bullets the weight of the 98 rifle is assumed to be 4.1 kg.—for the 98 rifle firing "S" bullet as

$$\frac{895\ (0.010 + 0.5 \times 0.00305)}{4.1} = 2.5 \text{ m/sec.}$$

6.5 g. bullet as

$$\frac{1500\ (0.0065 + 0.5 \times 0.005)}{4.1} = 3.3 \text{ m/sec.}$$

The 98 rifle firing a 9.0 g. bullet, as

$$\frac{1400\ (0.009 + 0.5 \times 0.006)}{4.1} = 4.1 \text{ m/sec.}$$

The work of the recoil affecting the rifleman amounts to:

$$\frac{2.5^2 \times 4.1}{2 \times 9.81} = 1.3 \text{ mkg.} \qquad \frac{3.3^2 \times 4.1}{2 \times 9.81} = 2.3 \text{ mkg.} \qquad \frac{4.1^2 \times 4.1}{2 \times 9.81} = 3.5 \text{ mkg.}$$

Hence even in the most favorable case, firing the bullet weighing 6.5 g., it is 77 per cent greater, firing of the bullet weighing 9 g. it is 170 per cent greater than when the 98 rifle is used firing an "S" bullet. It is ordinarily assumed that above 2 mkg. the recoil becomes unbearable.

AS to the second question, in the development of rifles the constant increase in the average density and, to almost the same extent, in the initial velocity, may be observed. About the end of the century the average density decreased a great deal in Germany, and only a little in other countries. This was done in order to obtain a form of projectile that could more easily overcome the air resistance. At the same time the initial velocity has greatly increased, as shown in the following table:

	Transverse density	Initial velocity
Minié rifle	7.1	315 m/sec.
71 rifle	18.8	440 m/sec.
88 rifle	29.8	640 m/sec.
98 rifle firing "S" bullet	20.3	895 (870)*
98 rifle firing heavy pointed (s.S.) bullet	26.1	785 (770)*

*The figures in parentheses apply to projectiles fired from machine guns.

The disadvantage of the low transverse density of the "S" bullet was soon recognized, and it was increased again in the heavy pointed bullet, while at the same time the form of the projectile was improved, with the result that at ranges of more than 700 meters the heavy pointed bullet, despite its lower initial velocity, has a longer trajectory than the "S" bullet. It is less important that the projectile should leave the muzzle at a very high velocity than that as little work as possible should be expended in order to overcome the air resistance.

With the aid of the tables of Siacci, assuming extraordinarily favorable shapes for the 7-mm. projectiles (form factor 0.40), the final velocities and the force of impact for the various ranges have been calculated and incorporated into a table as follows. For purposes of comparison the corresponding values for the heavy pointed projectile weighing

3. Only one-half the weight of the charge is used here; many use the factor 1.5 to 2.5 instead of 0.5; this would not greatly increase the velocity of the recoil.

12.8 g., as shown in the firing tables for the German machine gun, are given.

Range Meters	7.00-mm. rifle				7.9-mm. machine gun	
	Projectile weighing 6.5 g.		Projectile weighing 9 g.		Projectile weighing 12.8 g.	
	v	$v^2\rho$ mkg	v	$v^2\rho$ mkg	v	$v^2\rho$ mkg
	m/sec.	2g	m/sec	2g	m/sec.	2g
0	1500	745	1400	900	770	386
500	1063	374	1088	543	525	176
1000	684	155	832	295	376	90
1500	409	55	560	144	291	54
2000	286	27	387	69	241	37
2500	235	18	293	39	199	25
3000	195	13	255	30	165	17
3500	164	9	222	23	146	14

With an increase in the range the velocity decreases the more rapidly the greater the initial velocity and the lighter the projectile. The decrease in the case of the force of impact is much greater. While the final velocity of the 7-mm. bullet is still greater than that of the 7.9-mm. bullet at all ranges, the force of impact of the 6.5-g. bullet is less than that of the 7.9-mm. bullet at ranges of more than 1500 meters. In order to overcome the resistance of the air in a range up to 1500 meters, the former must expend a work of 690 mkg., the latter only 331 mkg., hence less than one half. At a range of 3500 meters the light bullet only has a work of 9 mkg. (1.2 per cent of the original work) still available, which is hardly sufficient to incapacitate a man, let alone a horse.

The perforation of a 12-mm. thick steel plate 50 meters from the muzzle is no very exceptionally great efficiency; the important thing is the efficiency at ranges used in actual fighting (500–1000 meters). Nothing is said about that.

In my opinion we should try to find out the progress made in the efficiency of the arms, not in the ways here indicated—the greatest possible increase in the initial velocity at the expense of the weight.

ONLY for antiaircraft guns can this method, if not carried to the extreme, perhaps be suitable. In view of the very steep trajectories of the projectiles fired from these guns the air resistance is decreased for two reasons. In the first place, the weight of the air is less at high altitudes and then the axis of the projectile on the rising branch of the trajectory—and this is the only one that is considered here—remains constantly near the tangent to the trajectory. Thus the velocity is better maintained, the trajectory is flatter, the time of flight decreased and greater altitudes are reached. All of which is very important in firing against airplanes. In this case a long barrel and a higher weight are of lesser disadvantage than in the case of rifles, hence greater initial velocities can more easily be attained.

I learned from the July number of the *Wehr und Waffen,* that in more recent tests with the 7-mm. rifle firing a 26-mm. long projectile[4] an initial velocity of 1600 meters per second has been attained, and even that with the same rifle, using other propellants—probably under a gas pressure greater than the normal—initial velocities of 1700 meters per second have been attained. It was expressly stated that the rifle had a normal weight and that the recoil was not excessively great.

In a calculation which I have made I have found the following:

With an initial velocity of	1600 meters per second	1700 meters per second
the muzzle energy is	845	957 mkg.
the average gas pressure	3140	3550 kg/cm²
the maximum gas pressure	6280	7100 kg/cm²
the work of the recoil	2.8	3.4 mkg.

These are efficiencies which, as has already been stated in the article, have so far been considered impossible and, I wish to add, have been considered impossible by me also because they defy the laws of mechanics.

According to reports in the newspapers the inventor has stated that he considers initial velocities of 3000 meters per second attainable for both rifle and cannon. The attentive reader will indeed realize from the above what opinion he is to have on the subject.

To prove these ideas we quote the following: The attainment of an initial velocity of 3000 meters per second would require a work of almost 3 mt. for a projectile weighing 6.5 g., and would require 20 g. of very strong powder. If the rifle is to be of normal length, it would have to withstand an average pressure of 110 700 kg. per square cm. (!!), and the recoil would not be less than 30.5 mkg.

We cannot issue too strong a warning against attempts to accomplish this, attempts which cost great amounts of money and which would ultimately lead nowhere.

4. It is incomprehensible why the author here gives the length and not the weight of the projectile; this merely makes the exposition harder to understand. I assume a weight of 6.5 g. in further investigations.

Japanese Tanks During a Lull in the Hostilities at Shanghai.

ARMY ORDNANCE

Published Bimonthly by
THE ARMY ORDNANCE ASSOCIATION
Washington, D. C.

MARCH-APRIL, 1932

Month by Month

THE bicentennial of the birth of General George Washington is a fitting occasion for the revival of a military decoration with which he was so prominently identified. One hundred and fifty years ago he wrote the general order establishing the Purple Heart as a badge of distinction in our Army. The War Department announced on the two hundredth anniversary of Washington's birth the revival of the decoration "out of respect to his memory and military achievements."

Revival of the Purple Heart

Washington's order well merits repetition. It read: "The General ever desirous to cherish a virtuous ambition in his soldiers, as well as to foster and encourage every species of military merit, directs that whenever any singularly meritorious action is performed, the author of it shall be permitted to wear on his facings over the left breast, the figure of a heart in purple cloth or silk, edged with narrow lace or binding. Not only instances of unusual gallantry, but also of extraordinary fidelity and essential Service in any way shall meet with a due reward. Before this favor can be conferred on any man, the particular fact, or facts, on which it is to be grounded must be set forth to the Commander-in-chief accompanied with certificates from the Commanding officers of the regiment and brigade to which the Candidate for reward belonged, or other incontestable proofs, and upon granting it, the name and regiment of the person with the action so certified are to be enrolled in the book of merit which will be kept at the orderly office. Men who have merited this last distinction to be suffered to pass all guards and sentinels which officers are permitted to do.

"The road to glory in a patriot army and a free country is thus open to all—this order is also to have retrospect to the earliest stages of the war, and to be considered as a permanent one."

Under the terms of the order reviving the decoration it will be awarded to persons who, while serving in the Army of the United States, perform any singularly meritorious act of extraordinary fidelity or essential service. Awards for acts or service performed prior to February 22, 1932, will be confined to: (1) those who, while serving in the Army, have been awarded the Meritorious Service citation by the Commander-in-Chief of the A. E. F. in the World War and who make application to exchange the certificate for the Purple Heart and oak leaf cluster pertaining to it; (2) to those who are authorized to wear wound chevrons. For acts or service subsequent to February 22, 1932, the Purple Heart will not be awarded after more than three years from the date of such act or service nor unless the recommendation therefor shall have been made at the time of such act or service or within two years thereafter.

Until its recent revival this decoration was awarded to only three recipients of record—all non-commissioned officers of Revolutionary times: Sergeant Daniel Bissell of Capt. David Humphrey's company, Second Connecticut Regiment, Continental Line, was the first recipient. The others were: Sergeant William Brown of Capt. Samuel Comstock's company, Fifth Connecticut; and Sergeant Elijah Churchill of the Second Regiment, Light Dragoons, which was recruited in Connecticut.

In addition to the rebirth of a significant historical award, the revival of the Purple Heart fills a long felt need particularly among many officers of World War experience who received citations which carried no decoration. Many of these and others are now eligible for the distinction which their "virtuous ambition and military merit" warrant.

LONG distance observers of military operations at Shanghai have wondered thus far in vain as to the part tanks performed in the several encounters. In all the maze of detail written by the press correspondents, little has appeared on this subject. Army Ordnance hopes to present to its readers an authentic analysis of the tank operations and results in this area but meanwhile curiosity causes much speculation as to the facts. The Sino-Japanese difficulties are the first major operations since the tank received its baptism of fire in the World War. Since then much has happened both mechanically and tactically. Claims and counterclaims have been made by at least two schools of thought, one hailing the tank to be something of a cure-all, the other insisting that it is an important auxiliary to the "queen of battle," the infantry. The atmosphere on both sides has depended on speculation. Certainly this is true as to post-war advancement at least. And for no better reason than that in thirteen years there had been no real conflict in which to place theory against fact. Proving ground tests of mechanical suitability or service board trials of tactical adaptability or even peacetime maneuvers are no measure of exactly what utility this newcomer in the ancient and honorable family of weapons is capable. It takes real battle to decide that.

How Did the Tanks Behave?

There are many angles to the Sino-Japanese encounter which will engage the various specialists. Some will debate the phases of international law, the value of the threatened boycott, the meaning of covenants and the rights of noncombatants. These have been the making of post-mortems for ages—conflict in its humanities and its principles is an unchanging factor. So also fortified positions have withstood constant attack with final victory or defeat since the year one. But the war at Shanghai can claim one origi-

nality—it is the first to test the modern tank in battle. If it really seized the opportunity then this practical proving ground of the up-to-date tank undoubtedly will teach some definite lessons.

A Department of National Defense

THE doctrine on the integral functions of the Army and Navy enunciated by Gen. Douglas MacArthur, Chief of Staff of the Army, in a recent letter to General Martin, Representative from Oregon, is such a sound and succinct statement that it deserves the broadest possible acquaintance. It is our brilliant Chief of Staff at his best and speaks for itself:

"You have asked for an informal expression of my views concerning the project for amalgamating the War and Navy Departments into a single bureau of government.

"No other measure proposed in recent years seems to me to be fraught with such potential possibilities of disaster for the United States as is this one. The proven agencies which have successfully conducted this country through six wars in a period of one hundred and twenty-five years are now under the apparent dictation of a measure of economy to be launched on an adventure which, under certain conditions, might involve the very life of the nation.

"Not only the military history of this country but of every other country gives indisputable proof of the advantages of maintaining in time of war the integral control of the two great branches of national defense—the Army and the Navy. Each must be free to perform its mission unhindered by any centralized and ponderous bureaucratic control. To those who have had practical experience in the conduct of war, this principle is so basic and clear that it seems almost impossible that serious thought could be given to any other arrangement. I know of no responsible soldier or sailor in the whole gamut of history who has advocated such a plan as is now proposed. From the beginning of armies and navies, the whole mass of testimony, not only of the great captains of history, but of all those students who have written upon the subject, has been practically unanimous in this matter. When the Congress of the United States, in 1798, for specific and cogent reasons, abandoned the unsuccessful attempt to administer the two great fighting services through a single department, it was but conforming to the lessons of history, to the accumulated experience of civilized peoples and to the dictates of logic. Fighting on the sea and fighting on the land have no elements in common, except in so far as they are both engaged in the ultimate mission of victory. Separate commanders, specialized staffs, particularized training and individual supply arrangements must remain as essentials for each. I will not attempt to burden you with a repetition of the manifold arguments along this line which have already been advanced. I merely wish to emphasize that I give it as my fixed opinion that such an amalgamation as proposed would endanger victory for the United States in case of war.

"As I understand it, however, the motivation of the proposition is not efficiency but economy. This feature of the subject has been discussed for weeks by your committee, and by other similar groups at various periods during the past decade, yet I challenge anyone to show a single major line of operation along which important economies could be effected without dangerously impairing efficiency. The proponents of economy have been unable to develop a concrete program outlining its factors. The basic hope they have advanced seems to be built upon the thought that the amalgamation will do away with certain overhead expenses. Small and trivial concrete cases have been cited of possible overlapping, and from these trivialities an opinion has been expressed that great economies may be accomplished by their elimination. The contrary result would obtain. Formation of the great organization proposed would not materially lessen the necessity for the separate logistical, administrative and training staffs now existing, but would at once attract to itself a group of officers, civil officials, clerks and others, which would probably exceed in cost and size during the course of time anything that this nation has ever experienced. The history of government demonstrates that the parasitical development of bureaucracy springs from the setting up of superfluous echelons of control, such as the one proposed. Although I recognize the possibility of effecting relatively unimportant economies in isolated activities, the ultimate cost of this superimposed structure would, in my opinion, exceed by millions any economies that could be safely effected. The super-cabinet officer at its head could not fail to be the acquisitor of one of the largest, and undoubtedly the most powerful governmental organization the United States has ever known. New buildings, new schools for the training of the composite soldier-sailor, new staffs, all with their additional cost, would be built up at the top of such a groupment. Rather than economy, this amalgamation would, in my opinion, represent one of the greatest debauches of extravagance that any nation has ever known."

The Controversy re Increased Velocities

GENERAL ROHNE'S article elsewhere in this issue on the practicability of increased velocities in the shoulder rifle is a scientific discussion by one of the world's leading ballisticians. In taking issue with the results claimed by Dr. Gerlich he places mathematical hypothesis against what the inventor claims as actual performance. Further developments will show, we hope, whether theory is stronger than alleged fact.

The significant under-current of these developments is the age-old demand for improvement in the weapon of the individual soldier. Every advancement in this field has had for its objective one or all three basic factors: accuracy, range and rapidity. From the flint lock to the percussion cap, to the rifled barrel, to the breech loader, to the semi-magazine, to the Springfield, to the semiautomatic, the entire evolution has seen in each successive step a distinct advance.

Just what effect velocities double those of standard practice will have on the progress of arms is open to conjecture. The first prerequisite undoubtedly is that they be practicable. Dr. Gerlich claims to have attained them. General Rohne doubts it. The next move, it would seem, is for the inventor to rebut the General with facts. Tests already made public tend to verify some of the claims. It is to be hoped that when the interests of the designer are sufficiently protected he will produce all the evidence in which there is considerable interest. As in all other modern advancements

we have by no means seen the last word in any development. The semiautomatic rifle proves that point and higher velocities will effect the general trend even more decisively.

On Reading "Newton D. Baker: America at War"

IN the voluminous literature of our Civil War references to the production and supply of ammunition, artillery, small arms, and other munitions of war are comparatively few in number. The character of the World War was entirely different and no discussion of it in this post-war period is adequate which fails to emphasize the enormously increased load which is placed upon industry by the demands of modern war.

The explanation is to be found in the tremendous advances made in the sciences and the mechanical arts during the half century preceding the World War. By way of illustration perhaps it would be well to enumerate some of the most important implements and appliances which were of the highest importance during the World War but which were entirely unknown during the Civil War: 1. Aircraft; 2. Automobiles, trucks, tractors; 3. Tanks; 4. Chemical warfare materials; 5. Smokeless powders and high explosives; 6. Rapid fire mobile artillery, and 7. Machine guns and other automatic and semiautomatic weapons, etc.

The artillery, small arms and ammunition of the Civil War period were of comparatively crude design and were easy to manufacture. They were all short of range and slow of fire so that consumption of ammunition was limited. Furthermore, armies were smaller in proportion to population. The mass production of today was unknown and unnecessary.

During the last fifty years the labors of the metallurgist, the chemist and other scientists have placed in the hands of engineers, inventors and designers vastly improved materials from which have been wrought the aircraft, the tanks, the machine guns, the rapid-fire artillery and other destructive implements of war which are used today. To develop the full power of these implements, vast quantities of ammunition must be supplied. In order that they may be kept constantly in condition for use, their maintenance and supply must be provided for on a huge scale.

Practically every implement of war with which an army of today is equipped is a complicated machine, and precision in its manufacture is essential. In order to achieve this precision tools, gages and machine tools of established accuracy must be provided. Aircraft, trucks, tanks and various calibers of artillery must be produced by the thousands, machine guns, rifles, etc., by the hundreds of thousands, and ammunition by the millions of rounds. Hence to equip and supply our armies mass production of complicated machines must be had.

Mass production is inspiring once the factories have commenced to produce in full volume. On the other hand, the vast and meticulous work necessary before the factory can be brought into production is sometimes heartbreaking. Not all of these things were fully appreciated by us before we made our World War effort. Our manufacturers are as capable as any in the world but perhaps they are inclined to be optimistic. Our public is impatient.

The very nature of our implements of war today demands a certain preparation for their production. That preparation demands a certain time. We cannot appropriate today and have the implements tomorrow. The conclusion is inevitable.

Mr. Frederick Palmer, in his "Newton D. Baker: America at War" (Dodd, Mead and Company, 1931), has made a most valuable contribution to the literature of the World War. All those who served under Secretary Baker will rejoice that he is receiving at least a measure of the great credit he deserves for the firm, generous and competent way in which he met his great responsibilities.

As one turns the pages of Mr. Palmer's book, one lives over again the hopes and fears, the enthusiasms and disappointments, and finally the achievements and successes. In such a tremendous undertaking mistakes will be made and criticism must be expected.

Two important conclusions for the Ordnance Department seem to stand out clearly: (1) We must reduce to the lowest practicable limit the time between the appropriation and the beginning of production in quantity; (2) we must have a reserve of sufficient magnitude to bridge the time that must elapse before production in quantity can commence.

Educational Value of Military Instruction

A STUDY of the educational value of military instruction in the universities and colleges recently completed by Maj. Ralph Cheney Bishop on behalf of the Research Organization on Military Education is a definite and extremely valuable analysis of the R. O. T. C. Its greatest worth is in the fact that it represents the opinion of graduates during the period 1920-1930. Hence it is the conviction of men who know just what our system of military education is.

Some 16,000 questionnaires were mailed and more than 10,000 replies were received. Every care was taken in formulating the questionnaire to avoid suggesting or influencing the answers. The questions covered the educational value of the R. O. T. C.; its quality in comparison with other courses at the institution attended; the value of the time spent in training as justified by the results obtained; and others relating to the development of leadership, initiative and discipline. This direct question was put, "In your opinion does the R. O. T. C. course of instruction tend to produce a militaristic attitude inimical to world peace?" Ninety-three and six-tenths per cent of the graduates replied to this question negatively and "stated very definitely that actual education in the destructiveness of war is conducive to a sane patriotism and an enlightened attitude toward peace." The group asserted that "the extent of its militaristic thought, as influenced by military training, was a belief in military preparedness as a security measure."

This is testimony from a source which permits of little speculation. Despite the insidious methods of some opponents of military training their claims too often have depended on appeal to mythical dangers which have never existed. In the midst of their efforts to undermine and tear down by appeal to the less patriotic within our gates, the finality and simplicity with which the graduates themselves have spoken in praise of military training as we have it, is proof positive of its great value, the distortions of impractical pacifists to the contrary notwithstanding.

National Defense—The First Function of Government

An Editorial

THE improvidence of Micawber is upon us. As a nation we are spending a good deal more than we are taking in. After the years of foolish feasting have come the days of frantic famine. Snap out of it we must and will—but the process is slow and painful. Everyone of us has a real job to do and none is more definitely indicated than that of the people through their representatives in the Congress to provide for the common defense. Balancing the national budget is a theme that plays on the pocket strings of all of us. True enough, general taxation and finance are the field of "ordnancites" only insofar as they bear on the national defense. Since there is danger that munitions progress will suffer in the retrenchment which Federal finances now face, the situation requires some clear-cut definition and action. There is no surer way to state the question than by a return to first principles. Such a statement may be made here with propriety because national defense is as closely related to our fundamentals as the Liberty Bell itself.

No one can deny that the Federal Government during the past quarter-century has shown an extremely paternalistic trend. That is to say it is carrying on a thousand and one extraneous functions in which it has little earthly warrant. No one political party is to be blamed that it is so, no one Congress is to be charged with all of it. We cite no one administration as the cause of it. As we have added to the structure from year to year with the mounting costs, we have lost sight of the basic purposes for which the Confederation of States was formed. And we come to the condition where employees of government—Federal, State and Municipal—are said to number one in five of our entire population. Every faddist it seems has had some new and costly operation added to the governmental machine to the detriment of the basic functions for which government originally was formed to fulfill. National defense should be number one on the list of essentials. Unfortunately it holds the same place as a target of those who would have Federal expenditures for every other activity but defense. Sane observers are beginning to demand that we return to basic conceptions and balance the budget not only by taxation but also by cutting out the frills and sticking to brass tacks.

WERE graphic charts not such prosaic things these days one could marshal an array of them to show that national defense in this country from the very beginning is a cheap form of insurance the premiums on which are kept at a ridiculously low figure. In fact, they have been kept far too low as our history shows. Even today the ratio of defense costs to national wealth is not disproportionate in spite of the frequent references to erroneous figures. Thus it is interesting to cite for the sake of the record that the budget of expenditures for 1933, including the District of Columbia, amounts to $3,942,754,614.22. Of this, the War Department total is $302,106,542 and the Navy $343,000,000, a grand total of $645,106,542. The figure for Veterans' Administration, for example, popularly cited as $1,000,399,527, huge as it is, still the figure is not accurate because it includes nearly $61,000,000 for civil service retirement and $79,427,000 for government life insurance, neither of which is appropriated from the Federal Treasury, being contributed by the beneficiaries themselves. The present favorite pastime is to charge the entire batch to national defense and a mighty impressive juggernaut is the result. While the costs of government have declined and risen and declined again, the complexities of modern life have created new demands to the point where many of the functions of private initiative have been dumped into the lap of government. Today amid all the trials of budget balancing we are fearful that the common defense has become secondary and the duplications of bureaucracy are looked upon as essential.

THE case in point can be demonstrated by two publications which are almost identical in size but as far apart as the poles in content. One is that ponderous tome, the Federal Budget for 1933: the other is the telephone directory of the City of Washington. The ramifications of Government expenditures are itemized in the former. Among all its facts the observant reader must stand aghast at the number and kind of purposes for which revenue must be raised. Their beginnings are often shrouded in the obscurity of the past but once begun they have taken title in perpetuity and have grown in cost and activity. That portion of the directory referred to under the heading "U. S. Government" tells its own tale. From the "Bureau of Agricultural Economics," the first entry, through several pages to "Zoölogical Park, Lion House" are gathered the mystifying titles of bureaus, boards and buildings that teem with activity and expense in the Federal City. Many are essential, some are necessary but many are foibles. The logical solution, however, is not always the expedient way out. And the national defense becomes lost in the melee. In these days of drastic scrutiny it would be well if the necessities of the times resulted in a sense of real values. Back to basic conceptions should be the cry. Then the national defense would take its place in the public mind as the first function of government and thereafter the hobbies and foibles of statesmen long gone whose fame rests on a new bureau added to the Federal machine for the promotion of this, that and the other, should take their place in order of importance. The remedy, however, will most probably be the other way around—further skeletonize our national defense at the expense of newcomers in the field of government. Sad to relate, in the minds of some such things as making the country grasshopper-proof and beer-proof, etc., are more essential to the public welfare than our modicum of protection with ships, guns and shell. Maybe the adversity of the times will bring us to a sterner realization of facts. Perhaps the burdens of taxation will force out the myriad administrative functions which should go back to private initiative if they are worth going back to anything. Maybe government eventually will get out of business in many fields that are not necessarily a part of it—a slogan long preached but seldom practiced. If so, the purge of depression and the extremes of budget balancing will have been beneficial experience. Believers in reasonable national defense fervently hope so.

Association Affairs

Annual Meeting of Trustees and Directors

THE regular annual meeting of the Trustees and Directors of the Army Ordnance Association was held in the Board Room of the Irving Trust Company, Park Avenue and 42nd Street, New York, N. Y., January 28, 1932. There were present Benedict Crowell, President; William W. Coleman, Vice-President; John C. Jones, Director; John Ross Delafield, Counsel; Chas. Elliot Warren, Treasurer; L. A. Codd, Executive Secretary; and by invitation of the Board, Maj. Gen. Samuel Hof, Chief of Ordnance, U. S. Army; and Lieut. Col. Chas. G. Mettler, Ord. Dept., U. S. Army, Executive Officer, New York Ordnance District.

In the temporary absence of the President, the meeting was called to order by the Vice-President, Colonel Coleman, who welcomed General Hof and Colonel Mettler and thanked them for their coöperation as evidenced by attending the meeting. The Executive Secretary was about to read the minutes of the last meeting when, on motion duly made, seconded and carried, the reading of the minutes was dispensed with and they were approved as recorded.

General Warren, Treasurer, presented his annual report on the financial condition of the Association. He reported a cash balance as of December 31, 1931, of $4,850.21, with no bills payable. He also itemized by classification the expenditures for the year which amounted to $25,368.21 and income from all sources in the amount of $25,369.86. He called attention to the annual audit of the accounts as of December 31, 1931, which shows all transactions of the Association to be correct and in good order. The Treasurer also called attention to the securities of the Association which are in the custody of the Irving Trust Company. The securities as carried in the Association balance sheet at the market value as of December 31, 1931, were approximately $8,000 less than par and approximately $9,400 less than cost. He also called attention to the fact that the net reduction in the operating reserve at the end of the year was approximately that of the reduction in market value of the securities. Upon motion duly made, seconded and carried, the report of the Treasurer was approved with thanks.

THE annual report of activities and affairs of the Association for the calendar year ended December 31, 1931, was read by the Executive Secretary and followed by discussion. During the reading of the report the President of the Association, General Crowell, who was unavoidably delayed en route from Cleveland, entered and assumed the chair as presiding officer.

The report follows, in part:

"I have the honor to submit the following report of activities and affairs of the Army Ordnance Association for the calendar year ended December 31, 1931, including details in respect of membership and of the financial condition at that time. I submit also for your approval recommendations as to the activities for the year 1932.

"Operations during the year were conducted in accordance with and within the limits of the directive of the Board of Trustees and Directors as approved at their regular annual meeting on January 29, 1931. From the standpoint of membership there was a net loss for the first time since 1923. There was a small net gain (46) in subscribers for the Journal of the Association. Financially the cash revenues were practically the same as cash expenditures, and the surplus for the year ($1.65), negligible as it was, maintains the unbroken thirteen-year record of the organization of operating without a deficit.

"1. *Membership.* During 1931 there was a net loss of 139 members. The membership as of January 1, 1931, was 3440, and as of December 31, 1931, 3301. During the year 305 new members were enrolled, while 444 were dropped from the roster through resignation, death and non-payment of dues. The number of members in arrears December 31, 1931, was 571 of whom 141 were in arrears more than six months, which compares with 332 as of December 31, 1930. The percentage of members dropped from the roster was 12.9, which compares with a percentage of 13.8 for 1930.

"The Spruance endowment, established in 1929 by the gift of Col. W. C. Spruance, a Vice-President of the Association, providing for faculty and student members in the School of Engineering of Princeton University, is functioning satisfactorily. New members, both of the faculty of the school and of the senior students, were nominated by University officials in October, 1931, in accordance with the terms of the endowment.

"During the year there were no additions to the life membership roster. There are now 10 life members enrolled.

"2. *Annual Meeting.* The sessions of the Thirteenth Annual Meeting of the Association were held October 7 and 8, 1931, with the United States Naval Institute and the National Industrial Conference Board participating.

"As in previous years, invitations and preliminary announcements were sent all members and invited guests. Approximately 6,000 each of the invitations and programs were distributed.

"The first session of the meeting was held in the Auditorium of the U. S. Chamber of Commerce Building in Washington on the evening of October 7th. It was featured by addresses by Maj. Gen. Geo. Van Horn Moseley, Acting Chief of Staff, U. S. Army; Rear Admiral Mark L. Bristol, Chairman, General Board of the Navy and President of the United States Naval Institute; and Mr. Magnus W. Alexander, President, National Industrial Conference Board. The attendance was highly satisfactory. The musical program was furnished by the United States Army Band Orchestra.

"Attendance at the Aberdeen session, October 8th, was approximately 10,000. The program of demonstrations by the Ordnance Department and other arms and services of the Army, including many special exhibitions, proved most interesting and instructive. All arrangements connected with the Aberdeen Meeting were handled in a highly efficient and expeditious way and reflect great credit upon the Commanding Officer, Col. E. M. Shinkle, and his staff. The Association is under renewed obligation to the War Department and particularly to the Chief of Ordnance, Maj. Gen. Samuel Hof, and his assistants—military and civilian—for their splendid coöperation.

"3. *Local Posts.* The number of local posts was not increased during 1931. There are eleven posts as follows: Birmingham (membership 93), Boston (membership 85), California (membership 160), Chicago (membership 107), Cincinnati (membership 72), Milwaukee (membership 60),

New York (membership 299), Philadelphia (membership 242), Pittsburgh (membership 186), St. Louis (membership 111), and Washington (membership 101). The total number of members affiliated with local posts is 1516, or approximately 45.8 per cent of the total Association membership. Plans are under consideration for the establishment of additional local posts when conditions warrant.

"4. ARMY ORDNANCE. Publication of ARMY ORDNANCE, the bimonthly journal of the Association, continued throughout the year on the same scale both as to quality of text matter and typographical arrangement as that achieved in the preceding year. The average size of the journal was 76 pages and cover, while the average press run was 4500 copies. Publication costs were checked carefully and were kept within the normal operating income allotted to this purpose.

"5. *Award of Medals.* The Board of Directors having approved the recommendation of the President that the Association found an Ordnance Medal of Merit for annual award, a committee was appointed to determine the specifications of the Medal and to recommend candidates to receive it. The Committee consisted of Col. Wm. W. Coleman, Chairman; Brig. Gen. Chas. Elliot Warren and Col. Frank A. Scott. Awards of the Medal of Merit for 1931, announced at the Washington session of the Thirteenth Annual Meeting, were made to Hon. Robert P. Lamont for leadership and administrative ability in the progress of munitions preparedness; Maj. Gen. William Crozier for achievement in the invention, design, development and manufacture of military armament; and Col. William C. Spruance for unusual accomplishment and outstanding service in the advancement of industrial preparedness. Posthumous awards of the Medal were made to Brig. Gen. Guy Eastman Tripp, Assistant to the Chief of Ordnance in charge of Ordnance Districts 1918, a member of the Founders Committee and later a Director and Vice-President of the Army Ordnance Association; and to Maj. Wm. P. Wilson for the design and development of the Wilson Antiaircraft Director, an instrument basically responsible for the progress of antiaircraft defense.

"Report of the Committee governing the specifications of the Medal, the number to be awarded each year, and the proposed candidates for award in 1931 are incorporated in the records of the Association. The medals were designed by The Bailey, Banks and Biddle Company and were of 14 kt. gold suspended on a distinctive ribbon.

"6. *Trophies.* The Ordnance Trophy, a Caliber .30 Sport Type Springfield Rifle, for award to the winner of the President's Match of the National Rifle Matches, was won by and presented to Sgt. Reginald A. Herin, Mississippi National Guard.

"7. *Financial Statement.* The excess of cash receipts over expenditures for the year, with all bills paid, was $1.65. Receipts from all sources were $25,369.86. Expenditures for all purposes were $25,368.21. Bank balance as of December 31, 1931, was $4,850.21. There was no change in the number and kind of securities in the Investment Account.

"Table 1 is a financial statement of income and expenditures for the year 1931. Table 2 is a statement of resources and liabilities as of December 31, 1931. The balance sheet discloses a reduction of the operating reserve from $26,544.27 to $17,726.72, a loss of $8,817.55. In accordance with the conservative policy of the Association, securities are carried at market value and this accounts for the reduction of the operating reserve. All other items of assets and liabilities are normal.

TABLE 1

Income Account for Year Ending December 31, 1931

Source	
Dues:	
Old Members	$10,496.90
New Members	1,082.50
Old Associate Member	3.00
Old Student Members	58.50
New Student Members	125.00
Old Group Members	4,350.00
Renewal Subscriptions	1,757.93
New Subscriptions	715.23
Advertising	4,755.90
Income from Investments	1,820.00
Miscellaneous	204.90
Total	$25,369.86

Expenditure Account for Year Ending December 31, 1931

Purpose	
ARMY ORDNANCE	$10,494.97
Refunds to Local Posts	605.50
Membership Extension	162.30
Annual Meeting	1,465.62
Rent	1,320.00
Salaries	8,805.00
Office Expense	1,025.00
Postage	541.54
Trophies	82.84
Office Equipment	113.25
Contingencies	752.19
Total	$25,368.21

TABLE 2

Balance Sheet

Assets

	1931	1930	1929
Cash on hand	$ 15.00	$ 15.00	$ 15.00
Cash on deposit	4,850.21	4,861.40	5,155.79
Accounts receivable:			
Due from advertising	275.00	377.50	65.00
Other Assets:			
Securities owned	24,231.25*	33,672.90**	31,367.65***
Postage	227.67	181.88	225.74
Permanent:			
Furniture, fixtures and supplies	1.00	1.00	1.00
	$29,600.13	$39,109.68	$36,830.18

Liabilities

	1931	1930	1929
Unearned income:			
Prepaid membership dues	$ 8,973.16	$ 9,706.31	$ 9,948.48
Prepaid subscriptions to magazine	1,077.75	1,036.60	812.25
Reserve:			
Endowment	822.50	822.50	822.50
Life memberships	1,000.00	1,000.00	800.00
Operating reserve	17,726.72	26,544.27	24,446.95
	$29,600.13	$39,109.68	$36,830.18

*Market value December 31, 1931.
**Cost. (Market value December 31, 1930: $33,890.00.)
***Cost. (Market value December 31, 1929: $31,412.30.)

"8. *Audit.* An audit of the finances of the Association was made by Messrs. Ernst & Ernst, certified public accountants, as of December 31, 1931. The audit covered the fiscal year 1931, the last previous audit having been made by the same organization as of December 31, 1930. The accounts of the Association were found to be correct and in good order.

"9. *Office Staff.* The number of salaried employees of the Association during the year 1931 was the same as during the preceding year. The office staff consists of the executive secretary, the assistant secretary and one clerk-stenographer. Fidelity bonds in ample amounts for these employees were continued through the year.

"10. *Budget 1932.* I submit the following budget of estimated income and recommended expenditures for the year 1932 for your approval:

(Note: Explanatory data in respect of each item are not published due to space limitations.)

(1) Old members	$ 8,500.00
(2) Old group members	3,300.00
(3) New members	2,000.00
(4) New group members	1,000.00
(5) Renewal magazine subscriptions	2,000.00
(6) New magazine subscriptions	880.00
(7) Advertising	3,000.00
(8) Interest	1,820.00
Total expected income for 1932	$22,500.00
(Total income 1931	$25,369.86)

"The approved budget of expenditures for 1932 is as follows:

(1)	Army Ordnance	$ 7,500.00
(2)	Rent	1,320.00
(3)	Office expense	1,000.00
(4)	Salaries	8,480.00
(5)	Postage	600.00
(6)	Annual Meeting	1,500.00
(7)	Extension	300.00
(8)	Post refunds	700.00
(9)	Contingencies	400.00
(10)	Trophies	100.00
	Total recommended expenditure	$21,900.00
	(Total expenditures 1931	$25,368.21)

AMONG the recommendations contained in the report was the following:

"The downward trend of membership in 1931 demands recourse to strenuous measures for regaining lost ground. I recommend the appointment of a committee to assist in this endeavor. A productive plan of action for the committee would be to request each member of the Association to secure at least one new member. In view of the popular interest in the subject of armament at this time I believe this suggestion would be well received by the membership. Other regular extension activities would be carried on concurrently. The committee should begin to function immediately. In conformity with this recommendation the following Membership Committee was appointed: LeRoy Hodges, Richmond, Va., Chairman; J. E. McNary, New York; Geo. P. Slade, Boston; Charles Z. Tryon, Philadelphia; E. D. Nims, St. Louis; James G. Cowling, Milwaukee; and W. M. Moody, San Francisco."

The next subject for determination was the date and place of the 14th Annual Meeting of the Association. The President suggested that the meeting be held as in recent years, namely, with two sessions; a business and technical session in Washington on the night preceding the Aberdeen demonstrations and the technical and scientific session at the Aberdeen Proving Ground, Maryland. On motion duly made, seconded and carried, it was unanimously resolved that the Aberdeen session of the meeting be held with the approval of the Secretary of War, at the Aberdeen Proving Ground, Thursday, October 8, 1932, and that the Reserve Officers' Association of the United States and the Coast Artillery Association be invited to participate.

The President then proposed for consideration the desirability of appointing special committees to draft resolutions on behalf of the Association concerning:

(a) Proposed legislation for a Department of National Defense. After considerable discussion it was regularly moved, seconded and carried that the President request Maj. Gen. C. C. Williams, a Director of the Association and former Chief of Ordnance of the Army, to study the matter and if in his judgment formal action by the Association be desirable that he report his findings to the President.

(b) Proposed legislation reducing the appropriations and curtailing the activities of the Ordnance Department. After discussion and on motion regularly seconded and adopted, the matter was referred to the President with power to act.

(c) Possible legislation materially reducing the officer personnel of the Army. After discussion and on motion regularly seconded and adopted, the matter was referred to the President with power to act.

General Delafield then discussed the activities of the several local posts of the Association and suggested that such posts as are relatively inactive be urged to undertake such activities as, in accordance with their purpose, they can exert both in behalf of the Association and of the several Ordnance Districts.

Word having been received during the deliberations at the meeting of the death on January 27th of Col. D. M. King, Commanding Officer of the Rock Island Arsenal, the Executive Secretary was unanimously directed to express to Mrs. King the sympathy of the Association.

There being no further business, and on motion duly made, seconded and carried, the meeting adjourned.

New York Post

ONE of the most significant meetings in the history of the New York Post, Army Ordnance Association, was held at the Army and Navy Club, New York, on the evening of February 5, 1932. Several hundred members and guests were assembled for dinner at which Brig. Gen. Samuel McRoberts, Ord. Res., newly appointed Chief of the New York Ordnance District, presided. The principal address was made by Hon. Frederick H. Payne, The Assistant Secretary of War, who was the guest of honor. (Colonel Payne's discussion is published in full on page 307.) Lieut. Col. Chas. G. Mettler, Executive Officer of the New York Ordnance District, was toastmaster. Other speakers were Brig. Gen. John H. Rice, U. S. Army, Ret., Chief Ordnance Officer, A. E. F.; Col. James E. McNary, Ord. Res., Vice-President of the New York Post; Mr. Kilbourn Gordon, Chairman, Lotus Club Entertainment Committee and an associate of F. B. Keech & Co.; and Maj. L. A. Codd, Executive Secretary of the Army Ordnance Association.

Among the distinguished guests at the speakers' table were Gen. John W. Joyes, Commanding Officer, Springfield Armory, and former Chief of Field Service, Ordnance Department; Brig. Gen. Chas. Elliot Warren, Commandant, Veteran Corps Artillery, New York; Vice-President of Irving Trust Company and Treasurer of the Army Ordnance Association; Brig. Gen. John Ross Delafield, Counsel of the Association, former Chief, New York Ordnance District, and Commander-in-Chief, Military Order of the World War; Gen. John J. Byrne, Commandant of Coast Defense troops, National Guard of New York; Rear Adm. R. R. Belknap, U. S. N., Ret.; Gen. J. F. Daniels, New York National Guard; Lieut. Col. John B. Rose, Commanding Officer, Picatinny Arsenal; Mr. Magnus Alexander, President, National Industrial Conference Board; Mr. Robert Boettger, President, First National Bank and Trust Company of Yonkers, N. Y.; Col. Calvin W. Rice, Ord. Res., Secretary, American Society of Mechanical Engineers; Mr. Malcolm Muir, President, McGraw-Hill Publishing Company and a member of the New York Ordnance District Advisory Board; Lieut. Col. Norman F. Ramsey, Corps Area Ordnance Officer, Second Corps Area, Governors Island, N. Y.; and the following officers of the New York Post: Col. H. B. Machen, Col. F. W. Roller and Maj. T. A. Morgan.

Other meetings of the Post will be held at stated intervals and a program of activity, including an election of officers during April, is receiving the energetic support of members.

St. Louis Post

FRIENDS of Col. Harry Scullin, Ord. Res., Vice-President of the St. Louis Post and a Director of the Army Ordnance Association, held a dinner in his honor, at the Jefferson Hotel, St. Louis, January 19th. Many members of the St. Louis Post were included among those present. Col. M. E. Singleton, Chief of the St. Louis Ordnance District, presided at the dinner.

Brig. Gen. Wm. H. Tschappat, Assistant to the Chief of Ordnance, represented General Hof and gave the principal address. He congratulated the officials of the St. Louis Post on the splendid work they have accomplished in their field and extended thanks and congratulations to the honor guest. Tributes were also paid Colonel Scullin by Mr. W. F. Carter, a Director of the St. Louis Post, and by Maj. L. A. Codd,

Executive Secretary, Army Ordnance Association. On behalf of the Ordnance Reserve Officer associates of Colonel Scullin in St. Louis, Lt. Col. E. D. Campbell, Ord. Res., presented a testimonial gift in the form of a very beautiful desk set. Colonel Scullin responded in his usual energetic manner and pledged himself to continued interest and activity in the ordnance cause. Approximately one hundred Reserve Officers and friends were in attendance.

Pittsburgh Post

AT a recent election the following officers of the Pittsburgh Post, Army Ordnance Association, were chosen: President: Ralph M. Dravo; Vice-Presidents: Taylor Allderdice and George G. Crawford; Directors: O. W. Buenting, Frank B. Bell, H. A. Gidney, C. W. Heppenstall, Julian Kennedy and E. T. Whiter.

Members of the Post and of the National Association as well join in congratulations to Mr. W. A. Irvin, formerly Vice-President of the American Sheet and Tin Plate Company, who was recently appointed to succeed Mr. James A. Farrell as President of the United States Steel Corporation. Mr. Irvin is a charter member of the Pittsburgh Post.

Cincinnati Post

A MEETING of the Board of Directors of the Cincinnati Post was held January 20, 1932, for the induction of new officers elected for the coming year. The gentlemen who will serve in the several capacities are: President, E. A. Muller; Vice-President, S. M. Rowe; Directors: C. L. Harrison, C. W. Verity, W. C. James, J. T. Faig, A. H. Pugh, R. T. Hazelton, F. V. Geier and E. E. Stokes; National Director, E. A. Muller; and Secretary, Maj. C. A. Walker.

General McRoberts, Chief of New York Ordnance District

A SIGNAL honor comes to Gen. Samuel McRoberts, Ord. Res., a Director of the Army Ordnance Association since its establishment in 1919 and a member of its founders committee, in his appointment as Chief of the New York Ordnance District succeeding Col. James L. Walsh, who is now Vice-President of the Guardian Detroit Union Group, Detroit, Mich.

General McRoberts was born in Malta Bend, Mo., December 20, 1863. He was graduated from Baker University in Baldwin, Kansas, in 1891, and completed his study of law at the University of Michigan in 1893. He holds the degrees of A.B., A.M. and LL.D. from Baker University and LL.B. from University of Michigan. General McRoberts first became connected with the legal department of Armour and Company and in 1904 was elected treasurer. In 1909 he became Vice-President of the National City Bank and a member of its board of five executive managers.

He was commissioned a major, Ordnance Reserve Corps, November, 1917, and was promoted to colonel in the National Army shortly afterward. In December of that year he was appointed chief of the Procurement Division, Ordnance Department, and directed the purchase of all ordnance matériel in this country which the huge program of requirements made necessary. On August 28, 1918, he was commissioned brigadier general and transferred to the A. E. F. From then until his return to civil life he was engaged in providing ordnance for the Army and disposing of supplies after the Armistice. Actively connected with many business and financial enterprises, General McRoberts was until recently chairman of the Board of the Chatham Phenix National Bank and Trust Company. His many friends in the Army Ordnance Association have expressed to him and to their associates their pleasure at his acceptance of this important office and tender to him every success in promoting industrial preparedness within the New York district.

As one of the prime movers in the establishment of the Army Ordnance Association, General McRoberts has done important work in the field of munitions preparedness during and since the World War. His appointment as Chief of the New York Ordnance District is a well deserved honor, the responsibilities of which he is especially qualified to meet.

Obituary

MR. MORRIS W. BUSH, a director of the Birmingham Post, Army Ordnance Association, died at his residence in Birmingham on January 24, 1932. Prominent in the business and financial fields in his community, Mr. Bush was president of the Alabama By-Products Corporation, a director of the First National Bank of Birmingham, and a member of its executive committee and also a director of the Realty Mortgage Company and the Protective Life Company. He was graduated from Vanderbilt University in 1899. He gave much of his time to civic and social activities both locally and nationally. Mr. Bush was a charter member of the Birmingham Post and was active in the activities of that organization since its establishment two years ago.

Necrology

SINCE publication of the last issue of ARMY ORDNANCE notice has been received of the death of the following members of the Association: Chas. A. Barton, Wilmette, Ill.; C. D. Fleming, Cleveland, Ohio; Youle T. Frazee, Montclair, N. J.; B. B. Greer, New York, N. Y.; Francis R. Larkin, New York, N. Y.; and T. Walter Martin, Brooklyn, N. Y. To the relatives and friends of these deceased members the Association extends condolences.

New Members

THE following have been admitted to membership in the Association since the last issue of ARMY ORDNANCE: John H. Abramson, Long Beach, Calif.; L. W. Baldwin, St. Louis, Mo.; C. A. P. Bartlett, Easton, Pa.; J. C. Cacho, Cincinnati, Ohio; Sherman W. Church, Norwalk, Conn.; C. T. Crocker, Schenectady, N. Y.; Riley M. Diener, Elkhart, Ind.; Walter C. Doering, St. Louis, Mo.; J. C. Dorman, Louisville, Ky.; W. L. Drissel, Cincinnati, Ohio; John Eberhardt, Cincinnati, Ohio; Arthur Feige, Cincinnati, Ohio; Carl S. Freudenberg, Norwood, Ohio; R. F. Goggin, Boston, Mass.; Elmer D. Hansen, Seattle, Wash.; Langdon W. Howard, Hastings-on-Hudson, N. Y.; H. D. Hubbs, Cleveland, Ohio; Wm. B. Jackson, Virginia Beach, Va.; H. B. Kilroe, Milwaukee, Wis.; Paul E. Klausmeier, Dayton, Ohio; Louis Koepnick, Jr., Dayton, Ohio; Harry J. Long, Cincinnati, Ohio; S. G. McAllister, Chicago, Ill.; Prentiss Nelson, Oakland, Calif.; Willis H. Palmer, Teaneck, N. J.; T. M. Parks, Jackson Heights, N. Y.; Norvin Perry, New York, N. Y.; A. Raymond Raff, Philadelphia, Pa.; T. J. Oakley Rhinelander, New York, N. Y.; Allen Rushton, Birmingham, Ala.; J. Blakely Ryan, Dayton, Ky.; Lawrence K. Sager, New York, N. Y.; Daniel M. Schwarts, Stanford University, Calif.; Wm. H. Skinner, Baltimore, Md.; William K. Stamets, Pittsburgh, Pa.; Lester M. Taylor, Cincinnati, Ohio; Julius Teres, Cincinnati, Ohio; S. F. Uhrig, Cincinnati, Ohio; William B. Updegraff, Elizabeth, N. J.; Charles R. Wagner, Hamilton, Ohio; W. K. Woodward, Indianapolis, Ind.

A cumulative index to ARMY ORDNANCE, Volumes I to XI, inclusive, compiled under the direction of Colonel Henry W. Miller, Ord. Res., Dept. of Mechanism, University of Michigan, is now available to members and subscribers. Arranged on 3 by 5-inch cards, the index may be purchased at cost f. o. b. Washington, D. C. Alphabetically arranged the price is $15.00 the set; not alphabetically arranged $7.50. Orders should be addressed to the Editorial Office, Army Ordnance Association.

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Professional Notes

Report of the War Policies Commission

THE War Policies Commission in its final report submitted to President Hoover and transmitted to Congress by him March 7th recommends that Congress submit to the States a proposed constitutional amendment defining the power of Congress to prevent profiteering and to stabilize prices in time of war.

Meantime, the Commission recommends adoption of a program which it sets out as governmental policy to minimize profits of war and to distribute its burdens.

Senator Vandenberg, of Michigan, member of the Commission, following submission of the report, introduced a joint resolution amending the Constitution to permit Congress to fix prices and levy extraordinary taxes in war times. He also sought action on a resolution to request the Secretary of the Treasury to draft legislation levying an extraordinary tax on profits during war.

The Commission also recommends that upon a declaration of war there shall be immediately available to Congress accurate and detailed estimates as to the Nation's man-power and material needs of the military and naval services, together with detailed recommendations relative to the most applicable methods of mobilizing men and procuring the required munitions.

The report is signed by 12 of the 14 members of the Commission, one of whom, Senator Swanson, of Virginia, is attending the General Disarmament Conference at Geneva. The other, Congressman Ross A. Collins, of Mississippi, submitted a minority report, in which he recommends as "the only way to eliminate war profits" a constitutional amendment to enable Congress to pass legislation creating an agency to fix prices of commodities.

THE report in full text follows: "The final recommendations of the Commission created by a congressional resolution entitled 'Joint resolution to promote peace and to equalize the burdens and to minimize the profits of war,' have been submitted by the Commission.

"Twelve of the 14 members of the Commission signed the recommendations. Of the two members not signing, one is attending the Disarmament Conference in Geneva, and the other prepared a minority report.

"On December 4, 1931, there was submitted to the President a preliminary report concerning the Commission's activities. An extension of time for the preparation of conclusions and recommendations was requested and granted in order that certain studies concerning constitutional law could be carried to completion. The Attorney General and others have carefully investigated the legal phases of the questions involved, and their conclusions were considered by the Commission in formulating its final report.

"During the course of its deliberations the Commission held a series of open hearings, at which many witnesses advanced diverse proposals and opinions bearing upon the intricate problems that presented themselves for study. The names of these witnesses and the complete testimony submitted by each accompanied the preliminary report.

"The report of the War Policies Commission follows:

"'To the President: The Commission appointed under Public Resolution No. 98, 71st Congress, entitled "Joint Resolution to promote peace and to equalize the burdens and to minimize the profits of war," respectfully submits the following report:

"'First, we recommend, in order to eliminate all doubt concerning the extent of the power of the Congress to prevent profiteering and to stabilize prices in time of war, that a proposed constitutional amendment clearly defining such power be submitted by the Congress to the States.

"'Second, we further recommend that until a constitutional amendment be adopted clearly defining the power of Congress to prevent profiteering and to stabilize prices in time of war, the following program be adopted as governmental policy in order effectively to minimize the profits of war and to distribute its burdens and sacrifices equitably:

"'(a) That the Congress should empower the President, in the event of war, to institute a program under which prices may be stabilized and thereafter adjusted at such levels as will minimize inflation and will secure to the Government the use of any private property needed in the prosecution of the war without affording the owner thereof profit due to the war. It should be clearly stated that such a program will not be placed in operation until Congress specifically directs it as a necessary measure in the conduct of the war.

"'(b) The Congress should empower the President to make, in war, such readjustments in, and additions to, the Executive Departments of the Government as are necessary to assure adequate control of all national resources. The President should be empowered also to fix the status, for the period of the war, of personnel transferred under this authority, from one Bureau or Department of the Government to any other.

"'(c) Existing law empowering the President to compel acceptance of war orders and to commandeer property should be continued.

"'(d) In addition to all other plans to remove the profits of war, the revenue law should provide that, upon any declaration of war and during the period of such emergency, individuals and corporations shall be taxed 95 per cent of all income above the previous three-year average, with proper adjustments for capital expenditures for war purposes by existing or new industries.

"'(e) In time of peace continuous planning by the Federal Government, particularly by the War and Navy Departments, should be directed toward insuring:

"'(1) That upon declaration of war there shall be immediately available to the Congress accurate and detailed estimates concerning the man-power and material needs of the military and naval services, together with detailed studies and recommendations concerning the most applicable methods for mobilizing the necessary men and procuring the required munitions.

"'(2) That there shall be no competitive bidding between Government agencies for the products of industry.

"'(3) There shall be no placing of contracts in excess of needs.

"'(4) That cost plus percentage methods of purchase shall be eliminated.

"'(5) That the munitions production load shall be distributed properly over the United States.

"'(6) That the governmental organizations required in the administration of war functions shall be set up promptly.

"'(7) That the necessary controls respecting prices, raw materials, transportation, priorities, war trade, finance, and related matters shall be continuously studied, so that in the event of war the will of Congress may be promptly and efficiently administered.

"'(f) Plans prepared in the War and Navy Departments for the accomplishment of the above should be continuously revised to meet changing national and international conditions, and should be thoroughly examined and revised at least every two years by appropriate congressional committees.

"'Third, we recommend that no constitutional amendment to permit the taking of private property in time of war without compensation be considered by the Congress.

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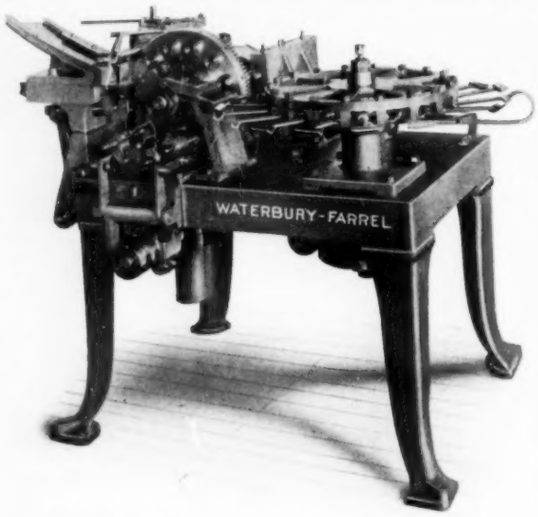

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THE resolution (S. J. Res. 115) to amend the Constitution, follows in full text:

"Resolved that the following article is proposed as an amendment to the Constitution of the United States which shall be valid to all intents and purposes as part of the Constitution when ratified by the Legislatures of three-fourths of the several States;

"At the end of the Fifth Amendment change the period to a semicolon and add the following:

" 'Provided, however, that in time of war Congress may regulate or provide for the regulation of prices, rent, or compensation to be exacted or paid by any person in respect of the sales, rent or use of any real or personal property, tangible or intangible, without regard to any limitation contained in this article or any other article of the Constitution.' "

Submission of the report in the Senate, to which it was transmitted formally by the President, was followed immediately with introduction by Senator Vandenberg, of Michigan, of a joint resolution to amend the Constitution "to make assurance doubly sure" as to congressional power in carrying out some of the recommendations. Senator Vandenberg told the Senate there was some doubt as to the right of Congress to fix prices in the manner proposed in the report, but there would be no doubt if the amendment to the Constitution were adopted.

Senator Vandenberg, who with Senators Reed, of Pennsylvania, Swanson, of Virginia, and Robinson, of Arkansas, were the senatorial members of the Commission, offered a resolution also to request the Secretary of the Treasury for the draft of legislation carrying out the taxation recommendation in the report. He was unable to obtain immediate action on this, however, for Senator King, of Utah, entered an objection on the ground that the subject matter was "too important to pass in this way."

The proposal of the Commission respecting price fixing, Senator Vandenberg explained, "revolves around the freezing of commodity prices at the time of the Nation's entry into hostility." He told the Senate that while the four Senators on the Commission entertained no doubt concerning the power of Congress, there was doubt expressed in several quarters whether this could be accomplished, hence the proposed amendment to the Constitution was offered. Senator Vandenberg said the Commission had moved to avoid the shortcomings of the excess profits tax by the levy of an extraordinary tax of 95 per cent of the amount by which war profits exceeded an average of three years prior to this Nation's entry into war.

Senator Dill, of Washington, took issue with Senator Vandenberg's explanation of the report in so far as it dealt with war profits. He asserted the Commission was directed to "take the profits out of war," and it was his judgment that it had failed to do so.

"We have proceded on the basis I have outlined," Senator Vandenberg replied, "because we thought we were getting somewhere. If taking 95 per cent of the profits above normal, does not constitute a frontal attack on the problem of taking profit out of war, then I am at a loss as to how to proceed."

THE minority report by Representative Collins follows:

"To the President:

"The purpose in creating the so-called War Policies Commission was to study and consider attending the Constitution of the United States to provide that private property may be taxed by Congress for public use during war and methods of equalizing the burdens and to remove the profits of war, together with a study of policies to be pursued in the event of war.

"I take it that the object of the resolution creating the commission deals solely with the purpose of eliminating profits that accrue to certain classes of individuals and corporations dur-

ing war and that 'a study of policies to be pursued in the event of war' relates to policies to be prescribed by Congress either through a constitutional amendment or by legislation for the purpose of eliminating war profits.

"As the Constitution of the United States is now drawn, I am convinced that the only way to eliminate war profits is through the adoption of a constitutional amendment so as to enable Congress to pass legislation creating an agency to fix prices of commodities either for the purpose of keeping profits at a minimum or the entire elimination of them. I heartily favor the adoption of a constitutional amendment to carry out this object.

"I do not believe it was the intention of the Congress that the power to fix prices of commodities should be delegated to military men. I believe that such administrative matters should be entirely in the hands of civilians and I object to any recommendation that would tend to confer upon military men the power to regulate prices or the activities of the civilian population during war or at any other time. I am firmly convinced, whether intended or not, that any war planning as now carried on by the War Department will in the end result in the administration of price-fixing laws and the regulation of civilian activities by military and naval officers if the recommendations of the majority members of the commission are finally adopted by Congress.

"I regret that I am unable to follow the majority of the members of the commission upon all of their proposals and respectfully submit to you this dissent.—ROSS A. COLLINS."

A CONSTITUTIONAL amendment would be necessary to vest in the Congress absolute power to fix prices of property and services during wartime, Attorney General William D. Mitchell advised the War Policies Commission.

But the Congress, even without a constitutional amendment, has the power to fix or freeze prices during the period of war, according to the Attorney General's opinion, made public February 28th, if the exercise of this authority would be reasonably necessary to the prosecution of the war and if the prices were not arbitrary or unreasonable.

The question of whether Congress, if it should adopt price-fixing measures in the exercise of its power relating to war without the express sanction of a constitutional amendment, acted within the limitations on this power would be subject to judicial review in the courts, Mr. Mitchell further ruled.

The Attorney General's opinion was given in response to a request of the War Policies Commission which was authorized by Congress to study and recommend policies to be pursued in war and further to determine whether a constitutional amendment would be necessary to effect recommended policies.

The general conclusions of the opinion are:

First: Under the power to declare war and provide for the common defense and conduct of military operations, Congress has authority to provide for regulating or fixing prices for property or services if the conditions are such that such measures are reasonably necessary or proper for the efficient conduct of the war.

The decision as to whether such measures are justified rests primarily with Congress. Its action must not be arbitrary, but must have a reasonable basis in fact. Its conclusion would be presumptively valid but would be open to judicial review, first as to whether there was any reasonable factual basis for the conclusion that the measures resorted to were reasonably necessary for the proper conduct of the war, and second, as to whether the prices fixed were wholly arbitrary or unreasonable.

Second: Whether price-fixing would have to be confined to a limited class of necessaries or might extend to the whole price structure, would depend on conditions at the time, and the

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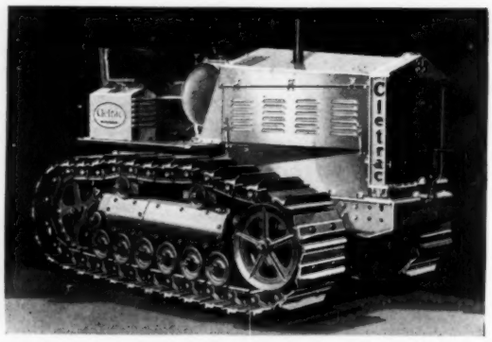

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extent to which it could be shown that the action taken was reasonably necessary for the national defense and the successful conduct of the war. It cannot now be said as a matter of law that the fixing of prices would necessarily be limited to the so-called necessaries.

Third: If the Commission is satisfied to rely on Congressional action subject to the above limitations and open to review by the courts as to their justification and the reasonableness of the manner of their exercise, no constitutional amendment is desirable.

On the other hand, if it is deemed advisable that Congress have absolute power with respect to these matters and as to the extent of price fixing in war time and that its judgment shall be conclusive both as to the necessity for price-fixing measures and as to the reasonableness of the prices established, a constitutional amendment would be necessary.

The Vickers-Carden-Loyd Light Amphibious Tank

ARMY ORDNANCE is pleased to publish the following letter from Vickers-Armstrongs Limited, London, with reference to a mis-statement of fact which appeared in the last issue of this Journal: "We notice in the article entitled 'Possibilities of the Air Tank, Part V: Sky Raiders' by Col. Fred. H. Wagner, which appeared in your Journal for January-February, 1932, it is stated in the opening lines that the Vickers-Carden-Loyd Light Amphibious Tank was 'invented by Captain Liddell-Hart.'

"We wish to point out that this invention can in no way be attributed to Captain Liddell-Hart. This gentleman has no connection whatever with this firm, being the Military Correspondent of the *Daily Telegraph*.

"The Vickers-Carden-Loyd Light Amphibious Tank was designed and manufactured at Vickers-Armstrongs' Tank and Tractor Experimental Station at Chertsey, Surrey.

"We hope that you will be good enough in your next issue to correct any misapprehension there may be in the minds of your readers as to the origin of this epoch-making vehicle."

To say that the error was unintentional is not to minimize the outstanding work of this great British ordnance organization whose developments and products have merited high acclaim throughout the world for many decades. In justice to the author, however, it should be recorded that *The Literary Digest* (Dec. 5, 1931) quoting *L'Illustration* and *The London Daily Telegraph* as well as *The Baltimore American* of the same date, referred to Captain Liddell-Hart as the inventor. ARMY ORDNANCE regrets the error.

New Attack Planes Developed for the Army

THE Curtis XA-8, the Army's latest model of attack airplane, has elicited great interest throughout the Air Corps. From the points of view of design and performance it appears most promising. The earlier attack airplanes were virtually modified observation airplanes of biplane type. For some years it was realized that the internally braced metal monoplane, with fuselage of metal monocoque construction offered reduced drag and parasite resistance in comparison with the biplane types, but an objectionable wing "flutter" when dived at high velocity made it impossible for military use. A vast amount of work devoted to this problem led to the elimination of this difficulty and the development of the present attack type, soon to be released for service testing to Air Corps stations.

Fuselage, wing, and landing gear of this airplane quite successfully fulfill the modern demand for aerodynamic cleanness. This airplane is a low-wing monoplane of cantilever two-spar construction. The exceedingly thin wing is wire-braced, with dural spars and built-up box sections. It is equipped with slots and flaps. The covering is fabricated from smooth duralumin sheet. Provision is made for the mounting of guns for attacking ground troops beneath the wing to either side of the fuselage.

The power plant of this airplane consists of a liquid-cooled Curtis V-1570-C engine, known commercially as the "Conqueror." It is rated at 600 h. p. at 2400 r. p. m. A three-blade metal propeller gives improved performance and justifies the increase in weight over the two-blade type. Speed is the predominating performance characteristic, and tests have proved this airplane to be faster than any foreign types that could be used against it.

Subcaliber Machine Gun

WHAT appears to be a satisfactory caliber .22 machine gun has been completed under a War Department contract with David M. Williams, of Godwin, N. C., and delivered to the Ordnance Department.

Preliminary firing tests were conducted and the gun functioned satisfactorily. Further firing tests were conducted at Fort Myer before representatives of the General Staff, Chief of Infantry and other interested personnel with satisfactory results.

The mechanism of this gun was designed to operate with the standard Browning Caliber .30 M1917 mechanism and use caliber .22 ammunition. An auxiliary feedway is interposed in the standard feedway of the gun, the feeding stroke has been reduced to handle the small cartridge and a web belt is used. The extraction from the belt and the feeding is somewhat similar to the standard Browning action, making it a particularly desirable method of operation for training purposes.

Secrecy Favored for Military Supplies

A BILL (S. 3173) which would authorize the President to class as secret or confidential certain material, apparatus or equipment for military or naval use was passed by the Senate March 10 and sent to the House.

In recommending passage of the bill with amendments, the Military Affairs Committee of the Senate explained in its report that the bill was proposed by the Secretary of War and submitted the following explanation given by the Secretary.

Certain material, apparatus, and equipment used by the Army and Navy is of such a nature that, in the interests of the public service, it should be kept secret. Under existing law it is impossible to procure such materials, except by Government manufacture, without disclosing their secret nature, because of the necessity for advertising and the publication of specifications, etc.

The proposition to exempt such materials from the provisions of law requiring advertising has been before Congress for some time. A measure, of substantially the same effect as the one here proposed, was passed by the Senate in the Sixty-ninth Congress and favorably reported in the House (see S. 1487, 69th Cong.), but the proposition has not been enacted into law. The War and Navy Departments both feel that the matter is urgent and merits favorable action by Congress.

Service Pistol League of St. Louis

MUCH interest is being shown in the Service Pistol League of St. Louis, a group of pistol teams composed exclusively of reserve officers. Teams in the league fire either the Cal. .45 automatic Colt pistol or the subcaliber "Woodsman" on courses and targets prescribed in Army Regulations. The League is prepared to accept a limited number of postal matches. Twenty officers or less can be placed on the firing line, and the league will fire either indoors using a 25-yard range or less, or outdoors. Scores for such matches can be certified either by a Regular Army officer, a member of the National Rifle Association or by a local police official.

Arrangement for such matches may be made with Maj. F. W. L. Peebles, Spec. Res., President of the St. Louis League, 721 Olive Street, St. Louis, Mo., or preferably with Lieut. Thomas F. Gentry, Secretary, 5157 Vernon Avenue, St. Louis.

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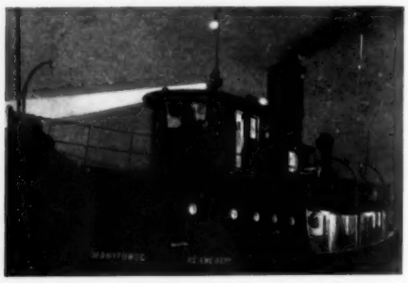

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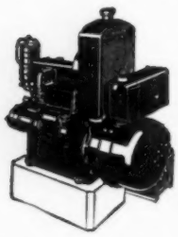

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Book Reviews

The Russian Army in the World War. By Lieut. Gen. Nicholas N. Golovine. New Haven: Yale University Press. 1931. $3.25.

THIS book, published for the Carnegie Endowment for International Peace, is the best exposition this reviewer has seen of how not to conduct a war, and where lack of preparedness, fostered by the actions of a benighted government, could lead to only one conclusion, utter failure.

The Russian "steam roller" was heralded by the Allies as the one trump card they had to play in the late summer of 1914, a card which not only failed to take the necessary tricks but which in the summer of 1915 was almost lost from the deck. The heroic sacrifices made by the Russians each time they were called upon by the Allies to exercise pressure on the armies of the Central Powers may have brought temporary relief, but were combined with losses which no "steam roller," however strong, could sustain for any length of time. This roller consisted principally of human flesh, but not of the armament necessary to win a modern war; nor were these heroic efforts answered in kind by the Allies who selfishly accepted the sacrifices as a matter of course.

This lack of preparedness started out with a totally inadequate conscription law, one which permitted many who should have been on the front to find safe berths in the rear. The army in the rear was almost as large as the one doing the fighting. Also we find a deficiency of adequate appropriations which, of course, meant a lack of arms and equipment; this latter condition became so bad that fresh troops sent to the front arrived without rifles, and they were compelled to take up those which had dropped from the nerveless hands of their fallen comrades, or rifles which in the majority of cases had been so mistreated that they were utterly useless. Then comes lack of artillery of all calibers, followed by a lack of manufacturing facilities for both arms and munitions. It was impossible to meet the original requirements, hence much less could needed repairs or replacements be furnished, a condition which improved somewhat towards the end. Lack of strategical railways compelled immense troop movements to be made on foot, and lack of interior railways prevented the proper supply of foodstuffs and clothing. Lack of ice-free ports with adequate unloading and storage facilities made even what was obtained from foreign lands unavailable for months.

The original officers were soon killed off, and the reserves sent to replace these lacked almost all the qualifications required to lead men. The losses in manpower were appalling, the killed and wounded amounting to 5,500,000 officers and men from the summer of 1914 to that of 1917; during this same period 2,500,000 Russians were taken prisoners by the Central Powers, a total loss of 8,000,000 men, while the largest number on the front at any one time was 6,900,000 on January 1, 1917.

It was shortly after this date when disintegration commenced, or after the February revolution, and in October, 1917, General Headquarters reports of this steam roller "The army is simply a huge, weary, shabby, and ill-fed mob of angry men united by their common thirst for peace and by common disappointment."

The peace these men desired was accorded them at Brest-Litovsk, thus marking the end of Russia's participation in the World War. "But the people of Russia did not obtain the

promised peace. Simultaneously with the seizure of power by the Bolsheviks civil war began, and one of the cruelest civil wars in history."

The reviewer would recommend this book to every reader interested in history, and especially to the careful attention of every pacifist in our midst.

Steinhauer: The Kaiser's Master Spy. By Gustav Steinhauer. New York: D. Appleton and Company. 1931. $4.00.

A STATEMENT of exceedingly interesting anecdotes in the life of a man who was in turn a sailor, courier, theatre attendant, tobacconist, detective, and finally the Kaiser's Master Spy. There is no need for detective thrillers when such a book is available. Steinhauer was christened "master spy" by the British, and even several years after the termination of the war his name still greatly exercised the London newspapers.

The book is divided into two parts, or his "Life in the Secret Service" and "In the Shadow of the Kaiser." In the first part we read of his espionage in England, Scotland and other countries, his activities having been devoted principally to naval matters. The British feel confident he obtained a great deal of information relating to the British fleet, but this is not always borne out by the narrative. He tells us that Graves, who was once proclaimed the "ideal spy" (principally by himself), was nothing more than a "smooth-tongued imposter," while Karl Lody, who was executed in the Tower of London, was a brave, likable man, but unfortunately no detective.

His accounts of women spys, such as Polish Mary and the Baroness in Green, are epic stories and a refutation of the statement often made by the British to the effect that women spys are worse than useless.

In the second part Steinhauer tells us the truth about the Kaiser as learned from twenty years of contact with him. Some of the anecdotes are amusing, others are tragic. His insight into the Kaiser's character is illuminating. His trip with the royal pair to the Holy Land is full of interesting experiences, and his account of what happened in London when the Kaiser went there to attend Queen Victoria's funeral is a thriller in itself. A picture is also painted of the German "dowry hunters"; this is interesting, but was not confined to Germany alone. Hours of real thrills are in store for those who read this book.

Wellington. By Philip Guedalla. New York: Harper & Brothers. 1931. $4.00.

WELLINGTON and Napoleon were both born in the year 1769. The contrasts between the two in birth, breeding, training and character are skilfully but unobstrusively evoked in this notable book. Wellington's early years, however, gave no hint of his future greatness. In fact, his discouraged mother considered him "food for powder and nothing more." So into the army he went with the help of family influence, and with no previous training he was gazetted ensign of infantry (in 1787) when he was eighteen years old.

His first military service was the arduous duty of aide-de-camp to the Lord Lieutenant of Ireland. Eventually, however, he broke his violin across his knee, put away childish things, and started to delve into many a serious book, a habit he never abandoned. Helped further by the constant solicitude of an influential older brother, he reached the grade of colonel at 27, and sailed for India. In that country as conquering soldier and able administrator of a province he gained much valuable experience and established a reputation that was destined to grow for many a decade.

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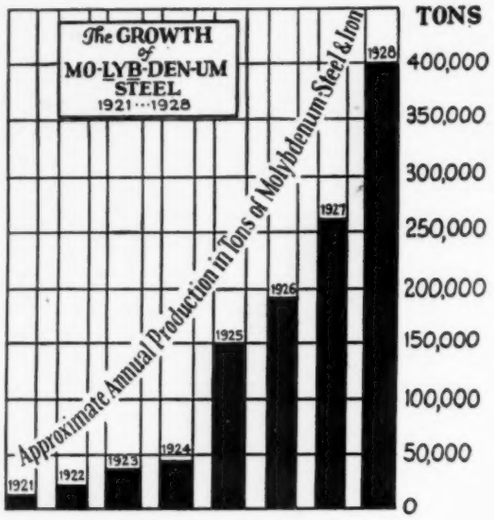

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The fullness of Wellington's long and active life presents a difficult problem to a biographer. What shall be mentioned, what passed over in so varied a career? Mr. Guedalla has brilliantly surmounted the difficulties in his path. This admirable biography attempting neither to exaggerate Wellington's virtues nor to belittle his accomplishments, is an accurate account of his intellectual development and of his achievements told with all the charm and ability for which the author is noted. Perhaps with some justice, the scientillating style of the author's earlier writing has been criticised as too much froth and too little substance. Certainly no such censure can be brought against this work. Here the substance is real and profound. Wellington is depicted as the universal man competent to undertake the many and diverse tasks that his country constantly imposed. The soldier of the Peninsular Wars and of Waterloo, the governor of a province in India, the governor of Ireland, the ambassador, the member of the British cabinet, the Prime Minister, the maker of a peace treaty that endured, the fixer of reparations that could be paid, pass in review in an astonishing picture of an extraordinary personality. Mr. Guedalla has immersed himself in contemporary documents, he has studied reports and orders, letters and memoirs, and the result is a satisfying biography. There is the expected brilliance, the charm and irony, that carry the reader through the voluminous pages.

No pronounced emphasis is given to Wellington's military activities in this book. We find him at last taking his profession with great seriousness as he sails for India. His interests are directed to acquiring a profound knowledge of the capacity of the individual to march and fight. He is forever arguing the importance of supply without which the best fighting men are worthless. In the Peninsular Wars he learns valuable tactical and strategical lessons. No *offensive à outrance* for him. He dares to retreat until a favorable moment appears to take the offensive. What a contrast with Foch who might profitably have studied Wellington's military conceptions. No great innovator, he nevertheless learned early in life the importance of mobility and fire power. It may be admitted that this is not the book for the reader whose sole interest is the military career of Wellington. John Fortescue still remains the outstanding authority in this field. But for an adequate and intensely interesting account of the many-sided life of this great soldier and statesman no better book exists now or is likely to appear soon to compare with Mr. Guedalla's preëminent work.

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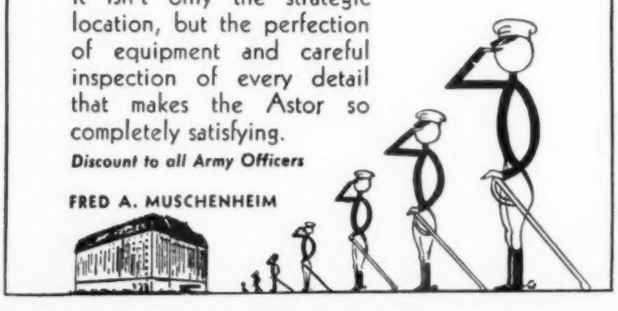
TIMES SQUARE NEW YORK CITY

INSPECTION

It isn't only the strategic location, but the perfection of equipment and careful inspection of every detail that makes the Astor so completely satisfying.

Discount to all Army Officers

FRED A. MUSCHENHEIM